SCIENTIFIC AMERICAN

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THE BOSTON SEWER SYSTEM AND MAIN DRAINAGE WORKS.

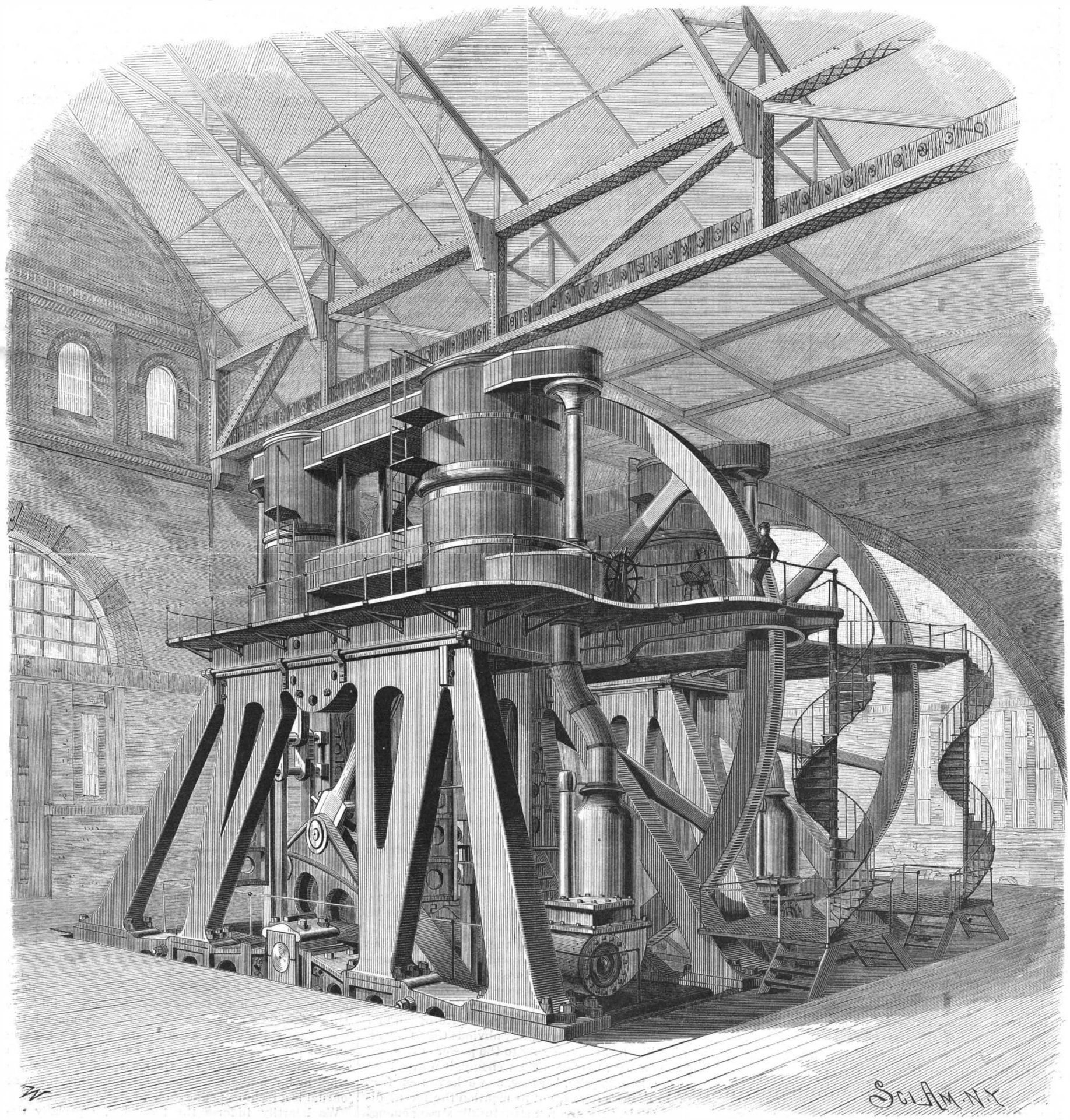
The city of Boston, Mass., has recently built and now has in full operation a system of sewage and drainage works that mark an important advance in sanitary engineering. A summary account of these works has already been published by us.* But as they include engineering work of the highest order, and as a number of perplexing problems are successfully solved in their construction, they appear to merit a fuller account.

By referring to the map of the city which accompanies this article, it will be seen that Boston lies upon a peninsula. On one side is the Charles River, separating it from Cambridge; on the other side are the waters of the South Bay; while a portion of its water front abuts directly upon the expanse of Boston Harbor. South Boston fills a second peninsula, which runs out into the harbor. Originally, the sewage was disposed of as in New York. It was allowed to run out into the water from numerous outlets. This was found objectionable. The water became contaminated, and the dock frontage was injured by the deposits of sludge. As the sewers were all constructed and in place, only the radical method of dealing with the problem seemed practicable. It was determined to surround the city with an intercepting sewer, which should receive the delivery from all the lines formerly discharging into the harbor and adjacent water. From this intercepting sewer, that was to encircle the city like a girdle, the sewage was to be taken to a distant point and, after proper clarifying, was to be discharged into the harbor.

Referring again to the map, the course of the new works, constructed in accordance with these ideas, may be traced. The old system, though still in place and in use, is not shown. The heavy black line encircling the city, and with branches running out into South

(*Continued on p.* 358.)

*See SCIENTIFIC AMERICAN SUPPLEMENT, No. 524.



MAIN PUMPING ENGINE OF THE BOSTON SEWAGE SYSTEM.

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Contents.

(Illustrated articles are marked with an asterisk.)

Alcohol, Prof. Horsley on..... 356
Animals, rare, burning of..... 353
Apparatus of Paris fire department* 354
Beet sugar at two cents a pound. 355
Boiler flue plug, anti-clogging*.. 355
Boilers, oil burning..... 357
Books and publications, new..... 363
Boots and shoes, army..... 356
Brake trials, interesting..... 360
Buildings, construction of improved* 356
Business and personal..... 362
Car coupling, improved*..... 355
Commerce, State regulation of.. 361
Correspondence..... 357
Cotton stalk cutter, improved*.. 355
Drainage works, Boston*.... 351, 358
Driven well suit, the decision in the..... 352
Electrical notes 359
Frogs in commerce..... 355
Gas lamp, new regenerative high power..... 354
Geese, Madagascar*..... 361
Intellectual improvement..... 352
Inventions, engineering..... 362
Inventions, index of..... 363
Inventions, miscellaneous..... 362
Iron against rust, protecting. ... 359
Langley, Prof. S. P., appointed secretary of Smithsonian Institution..... 353
Motive force of the world..... 357
Natural history notes..... 360
Nito-glycerine, explosive power of..... 360
Nitro-glycerine shells..... 356
Notes and queries 363
Paris fire department, apparatus of*..... 354
Planets, position of, in December.. 352
Reservoirs at Moon Island*..... 359
Salt, roadbed of..... 355
SCIENTIFIC AMERICAN..... 353
Sewer system, Boston*.....351, 358
Sheep, native, of South America 353
Ships, war, that are weak and slow..... 352
Sketching board, convenient*.... 355
Slide, the, at Lake Zug..... 354
Smithsonian Institution, secretary of..... 353
Tomb, Jay Gould's, in Woodlawn*361
Tool, combination, improved*... 355

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 622,

For the Week Ending December 3, 1887.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ASTRONOMY.—The Zodiacal Light.—By J. E. GORE, F.R.A.S.—This mysterious phenomenon described.—The opinion of different observers as to its cause..... 9938

II. BIOGRAPHY.—M. Eiffel.—Note of some of the engineering triumphs of the projector of the great Paris tower..... 9938

III. BOTANY.—Long Tailed Lady's Slippers.—By W. H. GOWER.—A remarkable family of orchids, embracing several hundred varieties.—1 illustration..... 9940
The Mesquit Bean.—The valuable food tree of the Southwest.—Its value in times of drought.—Its peculiarities and characteristics.—1 illustration..... 9939

IV. CHEMISTRY.—Analysis of Cider or Apple Vinegar.—By B. E. DAVENPORT.—The testing of vinegar for acetic acid and general examination for purity..... 9941
Curious Property of Gas Retort Carbon.—An interesting note on the power possessed by carbon of forming solid compounds with other elements directly..... 9942
The Chemical Basis of Plant Forms.—By HELEN C. DE S. ABBOTT.—First installment of a valuable contribution to chemical botany..... 9940

V. ELECTRICITY.—An Electrolytic Method of Preparing Metallic Alloys, etc.—By W. WARREN.—An interesting method of decomposing ores, etc., in the dry way by an electric current..... 9937
A Dining Room Electric Railway.—A electric waiter for supplying dishes at a dinner party.—2 illustrations..... 9927
Electricity as a Motive Power.—By WM. WHARTON, Jr.—An elaborate review of electricity as applied to the propulsion of street cars, with figures of expense and practical details..... 9927
Telegraphing to and from Trains in Motion.—Account of this last achievement in telegraphy, with full illustrations of the apparatus and its application.—4 illustrations..... 9929

VI. ENGINEERING.—Box Car Bodies.—Different types of framing for freight cars described and discussed.—3 illustrations 9932
Description of the New Tay Viaduct.—By Mr. F. F. S. KELSEY, resident engineer.—Full account of this great viaduct, the methods of construction, and the character of the completed structure..... 9930
Refrigerating Machinery for the Steamship Fifeshire.—The most powerful refrigerating machinery ever applied to ship work, producing an extremely low temperature by the expansion of compressed air.—3 illustrations..... 9931
The Change of Gauge of Southern Railroads in 1886.—By C. H. HUDSON.—An elaborate account of this great feat in engineering, with details of the treatment of curves, rail couplings, etc.—23 illustrations..... 9933
Tramway Engine.—An improved smoke-consuming tramway locomotive described and illustrated.—3 illustrations..... 9932

VII. MISCELLANEOUS.—The Kali Ghaut, Calcutta.—The steps leading to the Ganges for the use of Hindoo pilgrims.—1 illustration... 9938

VIII. NAVAL ENGINEERING.—History of Submarine Mining.—By SAMUEL RODMAN, Jr., U.S.A.—The second installment of this important paper, bringing the history down to the present day.—1 illustration..... 9935

IX. PHOTOGRAPHY.—Collodio-Chloride Positive Printing Paper.—By Dr. S. C. PASSAVANT.—A rapid and brilliant printing paper, with full formulæ and instructions for its use..... 9936

X. PHYSIOLOGY.—Ophthalmology.—The ophthalmoscope and its improvements and uses..... 9937
Serpent Venom.—The effect of the poison of snakes upon the human system..... 9937

XI. TECHNOLOGY.—Improved Wine Press.—A continuous press for wine or cider, driven by horse power.—1 illustration..... 9937
Manufacture of Starch, Dextrose, and Glucose.—By Prof. L. V. WAGNER.—New processes in this branch of technical manufacturing summarized..... 9942

THE DECISION IN THE DRIVEN WELL SUIT.

Copies of the full text of this important Supreme Court decision have now been received. The patent is declared invalid because the invention had been in public use two years before Green, the inventor, filed his application. This fact was conceded by the appellants to the Supreme Court. The appellants sought to sustain the patent while conceding this much by claiming that such public use did not render the patent invalid, because it was without the knowledge or consent of the patentee. The whole case turned, therefore, on this point, which involved the interpretation of the statute of March 3, 1839, in connection with certain sections of the statute of July 4, 1836.

This question has arisen for the first time among the numerous driven well cases, and curiously enough it had never been decided at all by the U. S. Supreme Court.

As the Green driven well patent was issued prior to the passage of the patent act of 1870, it had to be judged by the earlier statutes. So as a species of farewell decision upon them, this opinion is rendered upon one of their critical points. The court finds that knowledge or consent of the patentee was not needed under the old statutes to render a patent invalid where the invention had been in public use for two years before the date of application. This decision disposes of the famous driven well litigation, which by the expiration of the patent was fast losing interest except as a matter of history.

WAR SHIPS THAT ARE WEAK AND SLOW.

Captain Bunce's report to the Secretary of the Navy on the new cruiser Atlanta shows that ship to be ill adapted if not positively unfit for the purposes of war. He has commanded her since she was in commission, and we may, therefore, be sure he had ample opportunity to study her defects. The ship, he says, is well nigh unmanageable in rough weather, and her battery is too heavy. Add to this that she is both unarmored and slow, and it remains she can neither fight nor run away. Of the sister ship Boston, like unto her in construction and armament, the same is exactly true. Capt. Bunce suggests some fifty alterations, one of which is that she be built up out of the water both forward and aft. Such changes, it is said, would cost something like a quarter of a million and perhaps much more. These alterations, though adding to her buoyancy, would in no wise improve her speed, and it may thus be seen how profitless would be the task of the constructor who should undertake them.

It ought to be said here that in nowise can the Atlanta's defects be laid at the door of the contractor who built her, and there is not a word that could be construed into such an inference in Captain Bunce's report. It was not the contractor who decided she should have low bulwarks, not he who miscalculated the position of her load line when her guns were mounted and her coal bunkers full, not he who limited her speed to sixteen knots under favorable conditions. All this was done for him by the Naval Advisory Board. What could this Board have been thinking of? is the question that naturally suggests itself to those who rank far beneath its members as authorities on naval construction. They took for their model the Esmeralda, that admirable ship built for the Chilians by the Armstrongs, but seem to have utterly lost sight of the advantages of her wonderful speed while searching, vainly, it seems, for more stability. Speed, it has been shown, is more to be desired than heavy armor; but to an unarmored ship speed is, of course, a prime necessity, else she might find herself opposing her eggshell sides to the assault of heavy guns, and though these sides, like the Atlanta's and Boston's, were backed with bunkers filled with coals, they would, likely enough, prove at best but a sorry protection, if they afforded any at all.

But we are told: "These ships are not intended for the line of battle at all. They are simple cruisers for the protection and attack of commercial ships in time of war, and to carry the flag to different ports in time of peace. Their function is rather to keep the peace than to make war, and they are properly designated as 'the police of the sea.' They must, of course, be able to defend themselves from enemies of approximate size and similar character, and to escape by their speed from heavily armored ironclads of the enemy."

This is all very well, but with the exception of showing the flag, which our old hulks of antique type are quite able to do, these new cruisers are unable to fulfill the conditions as laid down by their apologists. They would not be able to protect commercial ships, because a reference to the muster of foreign ships shows many of them that have sufficient speed to overhaul them and power to beat them off; and as to their capacity to come up with the fast steam fleet of the European mercantile marine, it is immediately obvious that they are nothing like fast enough. As to the power of the guns of these cruisers to stand off an enemy, it were a bootless errand to inquire, because, as we have seen from Captain Bunce's report, not to mention the recent disastrous trials, they are not structurally strong enough to carry such guns.

As to the Chicago, Admiral Porter has told us over his own signature that she is filled with machinery of a complicated kind, put into her, willy-nilly, through the agency of the four branches of the circumlocution office which furnish machinery for ships, and that a merchant steamer, which he names as carrying engines of a similar type, spends half of her time laid up for repairs. There are war ships afloat to-day, not unarmored cruisers, but line-of-battle ships, that have a record of over nineteen knots an hour. There's the Spanish ship Reina Regente, with a record of 20·6 knots over the measured mile; the Dogali, built in England for the Italian government, 19·66 knots; the Orlando, built by private contractors for the English government, 19·25; and there are others which do not fall far short in speed of nineteen knots. How could an Atlanta, or a Boston, or a Chicago protect or attack a merchant fleet with such ships at hand? They could neither fight nor fly from them. What we want are fast cruisers, at least as fast as any afloat. Yankee ingenuity, which has never failed when put to the test, ought to be able to construct them. It is certain that Yankee ambition will not be content with any others.

POSITION OF THE PLANETS IN DECEMBER.

VENUS

is morning star, and may be found near Spica during the first part of the month. She reaches her greatest western elongation on the 2d, being at that time 46° 49′ west of the sun, and rising nearly four hours before the sun. Venus rises on the 1st at 3 h. 6 m. A. M. On the 31st, she rises at 3 h. 54 m. A. M. Her diameter on the 1st is 25″, and she is in the constellation Virgo.

MERCURY

is morning star. He reaches his greatest western elongation on the 6th, and is then 20° 36′ west of the sun. He is at that time and for a few days before and after easily visible to the naked eye. He rises at elongation nearly two hours before the sun. He is in conjunction with Jupiter on the 4th, being then 1° 35′ north, and may be more readily found, the brighter planet serving as a guide. Mercury rises on the 1st at 5 h. 21 m. A. M. On the 31st, he rises at 6 h. 51 m. A. M. His diameter on the 1st is 7″, and he is in the constellation Libra.

SATURN

is morning star and a most interesting object for observation as he makes his way through the cluster of stars in Cancer called Praesepe. He rises early in the evening in the northeast, and continues visible during the night. If the twin stars Castor and Pollux are familiar to the observer, Saturn is the first bright star southeast of them. Saturn rises on the 1st at 8 h. 37 m. P. M. On the 31st, he rises at 6 h. 31 m. P. M. His diameter on the 1st is 18·4″, and he is in the constellation Cancer.

JUPITER

is morning star. He is a conspicuous object throughout the month, rising an hour and a half before the sun at its commencement, and three hours before the sun at its close. Jupiter rises on the 1st at 5 h. 34 m. A. M. On the 31st, he rises at 4 h. 7 m. A. M. His diameter on the 1st is 29″, and he is in the constellation Libra.

MARS

is morning star. On the 12th, he is in conjunction with Eta Virginis, a star of the fourth magnitude. A good opera glass will show the planet and the star in the same field. Mars rises on the 1st at 0 h. 58 m. A. M. On the 31st, he rises at 0 h. 15 m. A. M. His diameter on the 1st is 6″, and he is in the constellation Virgo.

URANUS

is morning star. He rises on the 1st at 2 h. 33 m. A. M. On the 31st, he rises 0 h. 40 m. A. M. His diameter on the 1st is 3·5″, and he is in the constellation Virgo.

NEPTUNE

is evening star. He sets on the 1st at 6 h. 12 m. A. M. On the 31st, he sets at 4 h. 7 m. A. M. His diameter on the 1st is 2·6″, and he is in the constellation Taurus.

At the close of the month, Saturn, Mars, Uranus, Jupiter, Venus, and Mercury are morning stars; Neptune is evening star.

Intellectual Improvement.

"The habit of regular reading, if only for fifteen minutes each day, should be steadily cultivated throughout life. Besides the leading journals of his trade, which no carriage mechanic can afford to disregard in these days, at least one good daily paper should be read; and some standard work on science, history, or biography should be kept on hand for convenient opportunities; while an occasional light novel, when the mind is too weary for more solid food, will certainly do no harm. We also recommend the SCIENTIFIC AMERICAN as an instructive weekly record of progress in all the arts and sciences, which will be found stimulating to the active mind and broadening in its influence. The constant study of that journal is a technical education in itself."

We heartily indorse the foregoing, especially the two concluding sentences, for which we are indebted to that able and most excellent periodical, *The Hub*.

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Native Sheep of South America.

Consul Baker, of Buenos Ayres, in his last report, says that at the time the Spaniards first visited South America there were no animals in the country which exactly corresponded to the sheep of Europe, but they found in Peru, and in the regions of the Andes, several species of animals to which they gave the name of native sheep (*carneros de la tierra*), but which the aborigines called the llama, the alpaca, the guanaco, and the vicuna. The two first named varieties were even then nowhere to be seen in a wild state, but were domestic animals in the service of the natives. While there is a general similarity between these several classes, yet each one seems to form a distinct genus. The llama and the alpaca are of various colors, and sometimes speckled.

The guanaco and the vicuna are generally of a single color—brown, approaching to red. The llama and the alpaca are said to be so resigned to their state of domesticity that they are scarcely able to take care of themselves or live in a wild state.

The guanaco and vicuna prefer the wild state. Although these animals are all indigenous to the Cordilleras of the Andes, none of them are found north of Ecuador, neither in Quito, Bogota, nor Caracas, where the climate is similar to that of Peru or the Argentine Republic. The guanacos are especially found in the extreme southwestern portions of the province of Buenos Ayres, and in the desert ranges of Patagonia, as far south as the Straits of Magellan. There they are the principal food of the Indians, their skins being used for clothing and for coverings for their wigwams.

The Chilians and the Auricanian Indians also have an animal, which they call the *chilihueque*, which is supposed to be the alpaca of Peru, modified by the climate, and which they formerly used as a beast of burden, but the use of which has, in a great measure, been superseded by the introduction of mules. Of the several varieties of native sheep, the largest and strongest is the llama. It was especially esteemed by the native inhabitants as a beast of burden. Its load is about 100 pounds, although for short distances it is able to carry considerably more. Its height is from four to five feet, and the length of its body is about the same. It has no horns or hump, and its hoofs are cloven. Its body is shaped like that of the deer, with clean, slender legs, its cloven hoofs ending in talons or claws, like those of a bird of prey. Under its breast there is a hard substance, about six inches long and three inches wide, on which it sleeps or rests.

The llama is covered with a very fine silky hair or wool, which is not shed like that of the camel, but when properly cared for grows to a length of from three to four inches. The finest is on its legs. The animal rarely produces more than one young at a time, the period of gestation being six months, and it comes to maturity at three years of age. The Indians are very fond of the meat, esteeming it beyond that of any other animal. They dry it in quantities, and they regard the soup made from it as a sovereign remedy in nearly all cases of sickness. At ordinary labor the llama will last for twelve years, but those which are used in the mines do not live longer than three or four years, in consequence of infirmity caused by the sulphurous exhalations.

The size of the alpaca is a little less than that of the llama, its height being about four feet, the length of its body being the same, and its appearance when the fleece has been removed is very similar to that of the llama. Its hind legs are shorter than its fore ones, and are somewhat curved, and its hoofs are cloven, but the claws are very small. It drinks very little, but has a voracious appetite. When used as a beast of burden, it is capable of carrying from seventy-five to a hundred pounds, but not on long journeys. It is on account of its fleece that the alpaca is most esteemed, and this makes it the most valuable of the South American native sheep. The wool is long, soft, and abundant, being double the amount which the other varieties afford. On its side, breast, and back its fleece is from 8 to 16 inches long. It is of various colors, and sometimes speckled. Outside the wool, and sometimes protecting it, is a long hair, which is exceedingly fine, so that the fleece is really a combination of hair and wool. It is sheared by the Indians twice a year—in June and December.

The guanaco is from 3½ to 4 feet in length by about 4½ feet in height, and except in a few rare cases it is always found in the wild state. It is always of the same color—a brownish red—and in its general appearance resembles the llama, the chief difference being a greater curvature of the back, a more shaggy fleece, and smaller feet. The guanaco is the fleetest animal which South America produces, and it is so courageous that when surrounded by the hunters it will turn upon them and trample them under foot. It is generally seen in droves or flocks of from 200 to 300. The guanacos are vigilant and exceedingly circumspect in their movements, and when feeding they place one of their number as a sentinel, to announce the arrival of an enemy. The flocks which are now to be seen on the frontiers have generally a large excess of males, for the reason that, being stronger and swifter of foot than the females, they more readily escape the toils of the hunters.

The vicuna is the smallest and most delicately formed of all the native sheep, but its wool is the finest, and on that account it is the most interesting and the most highly prized. Its height is only about 3½ feet and its length about 2½ feet. It only weighs from 75 pounds to 100 pounds, while the llama weighs 250 pounds. In its general form and appearance it corresponds to the other varieties. Its head is erect, and is covered with wool of a reddish color, which is also the color of the fleece. Its wool is the finest, the softest, and the most silky that is known, and when it has been cleared of the hair that grows with it, it is regarded as the most valuable in the world. The wool on the back is without any mixture of hair, while on the rest of the body it is even longer than the wool—thus somewhat protecting it. The wool on the belly is white. The vicuna is gregarious, and inhabits the snowy peaks of the Andes, and the flocks are frequently mixed with those of the guanaco. They are very timid and difficult to secure, but it is estimated that about 250,000 vicunas are still annually hunted down.

Consul Baker says that only a small quantity of wool of any of these animals is shipped from the country. The exact amount, however, cannot be known, for the reason that the exports of wool are not classified by the authorities. The greater portion is consumed in the country, and is used by the inhabitants of the interior in the manufacture of yarns, threads, and a variety of woolen textures. The best of the native fabrics are made in Catamarca and some of the other upper provinces, but not in sufficient quantities to meet the demand.

The principal merit of the native shawls, pouches, etc., is that they are entirely impervious to water, at the same time that they are light and fine, and they readily command high prices, ranging from one to five hundred dollars, according to their finish, but it takes, says Consul Baker, many months of hard work to complete the fabrics.

Burning of Rare Animals.

The winter quarters of Barnum's menagerie, at Bridgeport, Conn., were destroyed by fire on the night of November 20. It was the work of an incendiary.

The building containing the bears, monkeys, and many smaller animals was saved. The list of the dead includes four elephants, namely, Alice, Samson, the sacred white elephant, and a smaller one, four lions, seven leopards, five panthers, two sea lions, two zebras, the hippopotamus, besides kangaroos, ibexes, warthogs, etc.

The lions first gave the alarm, in which the other animals joined, their roarings and howls of pain being heard above the noise of the flames. The rhinoceros broke his chain and came crashing through a side wall badly scorched. It is thought that he will recover.

The prompt action of Otto Mabis, the elephant trainer, was remarkable. He entered the burning building and unchained most of the elephants. Twenty-seven of these huge beasts were thus liberated. When he came to the savage Samson, by whom one keeper had formerly been killed and many a one injured, the creature knocked his benefactor down, and acted in such an ugly manner that it was impracticable to release him, and he perished. The lion tamer, Tim Buckley, also entered the building and freed a favorite old lion that followed him with the greatest docility out through a window. The appearance of all these monsters created a panic among the vast crowd that had assembled to witness the fire. One man was knocked down by an elephant, though the occurrence seemed really accidental. He had three ribs and one of his legs broken. After the first rush the elephants clustered together in an adjacent field and stood looking at the fire, until they were cared for by the keepers. Some of them subsequently wandered away, and were found in various door yards in the morning. One unlucky beast tried to swim across Long Island Sound. Failing in the attempt, he landed on a small island, whence, in the morning, some men dislodged him. He then made for the shore; but being chilled through, he sank in the muddy flats and perished.

The enormous hide of Jumbo was stored in a carriage house, and was but slightly damaged, while his bones were safe in the Philadelphia Museum.

Many ludicrous anecdotes are told concerning the rambles of the elephants and other liberated animals, which may be true or otherwise.

But the pitiful fate of the great lion set free by his keeper is worth telling. No sooner did he appear outside the burning building, than a couple of police officers began firing at him with revolvers. The keeper begged them to desist, as he was confident that he could control the animal and secure him in some place of safety. The wounded lion took refuge behind a freight car, where his keeper captured him again and presently put him into a pen. The inclosure was not sufficiently strong, however, and after a while the lion started on his travels. In jumping over a fence he alighted on a reporter for the London *Times*, who never was more surprised in his life. The man escaped with a few scratches, and the lion went its way. During the night, a Mrs. Gilligan heard a disturbance in her barn, and supposing two of the cows to be fighting, undertook to part them by pounding them with a hoe handle. The cow she was pounding proved to be the lion, and answered by a frightful growl. Giving the alarm, a neighbor brought a rifle and shot the lion dead. It was found that he had torn the side of a cow, and had begun to make a repast of her calf. The boys who visited the spot in the morning cut off the tail and paws as trophies, against the remonstrance of the owner of the cows, who felt herself entitled to damages.

The building that was burned occupied a ground space of 100 by 400 feet, and was two stories high. It contained much valuable property besides the animals, and the total loss must exceed $200,000. It is thought that Mr. Barnum will rebuild at some point nearer New York City.

The remains of most of the animals were subsequently disposed of by burning. The bones of a lion and of the hippopotamus were secured for the Yale Museum. They were found in good preservation, the latter especially being protected by his enormously thick hide. The skin was found to be fully two inches thick when the animal was disarticulated for transportation. Representatives of various medical schools were on the ground, looking after such specimens as could be obtained for anatomical study.

The Scientific American.

As the time is close at hand when intelligent people will consider the subject of subscribing for desirable papers for the coming year, we will quote the remarks of the able editor of the *News*, published at Sandy Lake, Pa., respecting our work:

"While attending Westminster College in 1857, a classmate traded us his SCIENTIFIC AMERICAN for the last half year of his subscription. We received and read it regularly every week. We at first thought it pretty dry reading, partly because we were unacquainted with the mechanical and scientific terms used in describing the machinery of which every issue had a number of fine engravings. We determined to get out of the paper as much as we could, and think we were well repaid for the time and labor spent in the reading and studying of this very reliable and able magazine. It was our rule, when we sat down to read the SCIENTIFIC AMERICAN, to lay a copy of Webster's Unabridged Dictionary on the desk where we could turn to it for the meaning or definition of any new learned, scientific, strange, or mechanical term we found in the paper and with the meaning of which we were not familiar. In this way we not only learned the meaning of a great many, to us, new and technical phrases and terms, but we soon found much pleasure and mental profit in the perusal of this standard weekly. We studied chemistry, natural philosophy, geology, and other branches of natural science with much more interest, and found our reading in the AMERICAN of great use to us in our investigation of these branches of study. We now are, and for years past have been, receiving the SCIENTIFIC AMERICAN, and though it is now twenty-seven years since we left college never to return, the taste for the study of natural science the reading of this able weekly then helped to cultivate gives us pleasure every time we can get leisure from our editorial and other work to read the paper. We may add that the SCIENTIFIC AMERICAN increases in value by age, like good wine, and we now consider it a much better paper than when we first commenced reading it in our boyhood. To young men and women of an investigating turn of mind, and to all who have a love for study, especially young mechanics and machinists, we would suggest that we know of no way they could spend the money to better advantage than by sending for the SCIENTIFIC AMERICAN, 361 Broadway, N. Y., and receiving it, study its regular weekly edition as we did, determined to learn what we could from it. Try it, and you will say it is one of the best school teachers to impart valuable and reliable information on a thousand things of practical use and permanent benefit to everybody."

Appointment of Prof. S. P. Langley as Secretary of the Smithsonian Institution.

At a special meeting of the Board of Regents of the Smithsonian Institution, held in Washington, November 18, Professor S. P. Langley was elected secretary of the Institution, to succeed the late Professor S. F. Baird.

In making this selection, a wonderfully happy choice has been made. The life work of Professor Langley has already been described by us, and his portrait appeared in connection therewith. His work in mathematics and physics and physical astronomy has won him a worldwide fame. His researches in radiant heat are already classical. He presided last summer over the meeting of the American Association for the Advancement of Science, at Columbia College. The Smithsonian Institution in his appointment will secure as earnest a worker as his lamented predecessor, Professor Baird, while in the change from biologist to physicist and astronomer as her secretary, a broadening influence will undoubtedly be felt. The portrait of Professor Langley, with his biography, will be found in the SCIENTIFIC AMERICAN of August 20, 1887.

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A New Regenerative High Power Gas Lamp.

A regenerative gas lamp, which is claimed to be one of the most efficient, as it is certainly about the simplest of its order, has been perfected by Messrs. S. Chandler & Sons, of Kennington Oval. The "Chandler" lamp, as it is called, scarcely differs in general appearance from any of its congeners—the inverted-flame inclosed lamps, with air and, to some extent, gas heated on their downward course to the point of ignition by the ascending products of combustion. It has a similar central gas pipe surrounded by the same kind of chimney, rising out of the familiar enlarged semi-globular lamp body, closed at the bottom by the railway lamp glass. The flame also resembles in shape what has been seen before in more than one kind of recuperative lamp; being like an inverted mushroom. The most striking feature of the "Chandler" lamp is, however, the simplicity of the construction by which this now familiar phenomenon of the silent, steady, brilliant button of shadowless flame is produced. Strange as it may appear, the lamp has positively no burner at all. Other lamps of the genus have some sort of burner, generally of the Argand type, although the holes from which the gas issues may be made horizontally, upright, or reversed, in a steatite or metallic body. Considerable importance has always been attached to the shape and position of these burner holes, or of a slit which has been made to take their place, with reference to the form that has been imparted to the flame by these openings and by the direction and force of the current or currents of air by the aid of which the flame is sustained. All this has been suppressed in this new lamp. There is no burner, and consequently no holes—the gas supply pipe simply coming to an end at its appointed level in the body of the lamp; and the gas burning there without anything that can be called a burner tip to regulate its shape or direction, which depend wholly upon the influences of the gentle gas flow, the current of hot air, and the draught of the chimney upon the products of combustion.

As to the comparative duty of the "Chandler" burnerless lamp, we have no independent information. We can, however, vouch for its burning well with a good shaped flame, and its brilliancy as the result of recuperation is self-evident. It is claimed that the fact of the hottest part of the flame being at some distance from the actual end of the gas pipe is sufficient protection for the latter against undue waste or corrosion. In any case, the advantage of a lamp having no holes for gas smaller than will admit of a substantial rod for clearing out any deposit may be largely appreciated. The heat recuperator portion of the lamp is also of the simplest character and of most substantial construction. Altogether, the apparatus appears to be an addition of practical value to the fast increasing list of recuperative high power gas burners.—*Jour. of Gas Lighting.*

The Slide at Lake Zug.

On July 5, 1887, at the town of Zug, in Switzerland, a portion of the shore gave way and sank into the lake. About three hours later another much larger adjacent area also suddenly subsided, so that in all an area considerably over two acres, with half of one of the principal streets, was submerged to a depth of about 20 feet. It can be seen that the subsoil consists of coarse gravel and sand, followed after a few feet by soft, wet sand and fine mud. According to Professor Heim, this fine mud or sludge reaches to a depth of nearly 200 feet, and the disaster is shown to be due to a flowing out into the lake of this mobile sludge from under the superincumbent weight of buildings and firmer ground. The buildings collapsed as they sank. The catastrophe must have been long impending. The exact cause which precipitated it is undetermined, but a low level of the lake and tremors from pile driving for new quays are suggested as contributories.—*Geol. Mag.*, *October*, 1887.

APPARATUS OF THE PARIS FIRE DEPARTMENT.

The steam fire engine used in Paris is of the Thirion type, and is always accompanied to a fire with a carriage that may be called its tender. This carriage (Fig. 1) carries 2,500 feet of hose, wound round two reels between the two hind wheels, a supply of coal, a number of hose couplings, and all the accessories of the engine.

Besides this, there is another carriage that serves for carrying quickly to a fire the first apparatus necessary and the men for maneuvering it. This carriage consists of a platform in front for an air pump and of a strong box behind for the reels. This box, which is surmounted by a chest and two benches, is supported by a cranked axle and two wheels of wider diameter than the ones in front. The horses are harnessed to whiffletrees, attached to a splinter bar, and the pole, being stationary, does not oscillate and thus fatigue the horses.

The carriage is provided with two hose reels and a pump, two scaling ladders, a life saving sack, a sliding ladder, a hook, and an air pump and fireproof suit, to allow of places being entered where the air is irrespirable. The carriage is provided also with a Trouve electric lamp, a miner's lamp, maps of Paris, and a memorandum book showing the location of the hydrants and the pressure and nature of the water at each. The carriage carries a foreman, three assistant foremen, twelve firemen and corporals, and a driver. Its total weight, when ready to go to a fire, is 7,313 pounds.

We do not present a figure of this carriage, since it looks so much like the tender shown in Fig. 1; but we must call attention to one of the most important apparatus that it carries, and that is the Paulin cellar-fire apparatus. This consists of a suit like that used by divers, which allows a fireman to enter a cellar in which the air has been rendered irrespirable by a conflagration. When it is a question of an ordinary fire, and the air of a room is filled with smoke, the firemen, by taking special precautions, manage to enter,

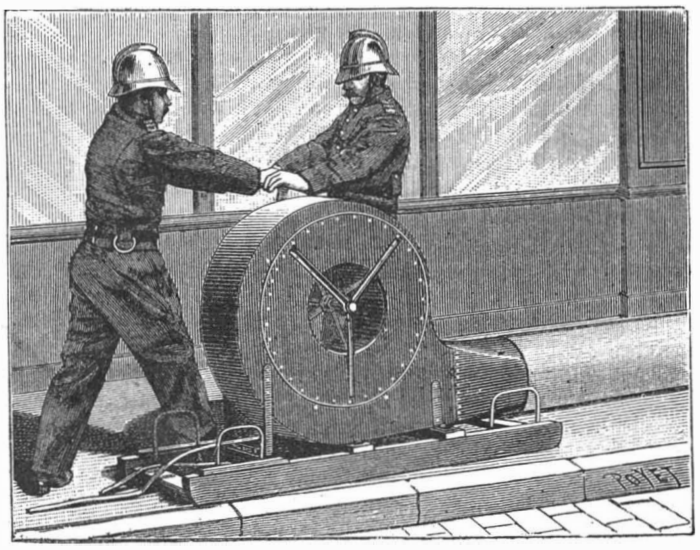

Fig. 3.—VENTILATOR.

but this cannot be done when a cellar is filled with illuminating gas or the products of combustion of sulphur, India rubber, and a number of other substances that furnish asphyxiating gases. In order to locate the fire in such a case, it is necessary to have recourse to the apparatus under consideration. The fireproof suit consists of a leather blouse, fastened at the waist and wrists with ligatures, and provided with a hood and iron mask. The air necessary for respiration is introduced through an aperture in the back of the suit, by means of a rubber tube of great length. The blouse is very roomy, and allows of great liberty of motion. Fig. 2 shows the method of using the apparatus. After the fireman has visited the room filled with deleterious gases, and has made known the seat of the fire, and the men have got the better of the latter, the air remains impregnated with gases that render the room inaccessible, and it becomes necessary to remove such gases, and substitute pure air for them. It is here that intervenes a new apparatus—a centrifugal force ventilator. This apparatus, which is carried on a push cart, consists of curved buckets which when set in motion suck in respirable air, and force it into a pipe of wide diameter that runs into the cellar. This ventilator discharges 14 cubic feet of air per second.

As the gases are generally hot and light, the air thus forced in easily replaces them. Were it a question of very dense gases, heavier than the air (carbonic acid gas for example), a special ventilator would be used, that of Enfer, which forces in air under pressure. As this apparatus is rarely used, we do not think it necessary to describe it.—*La Nature.*

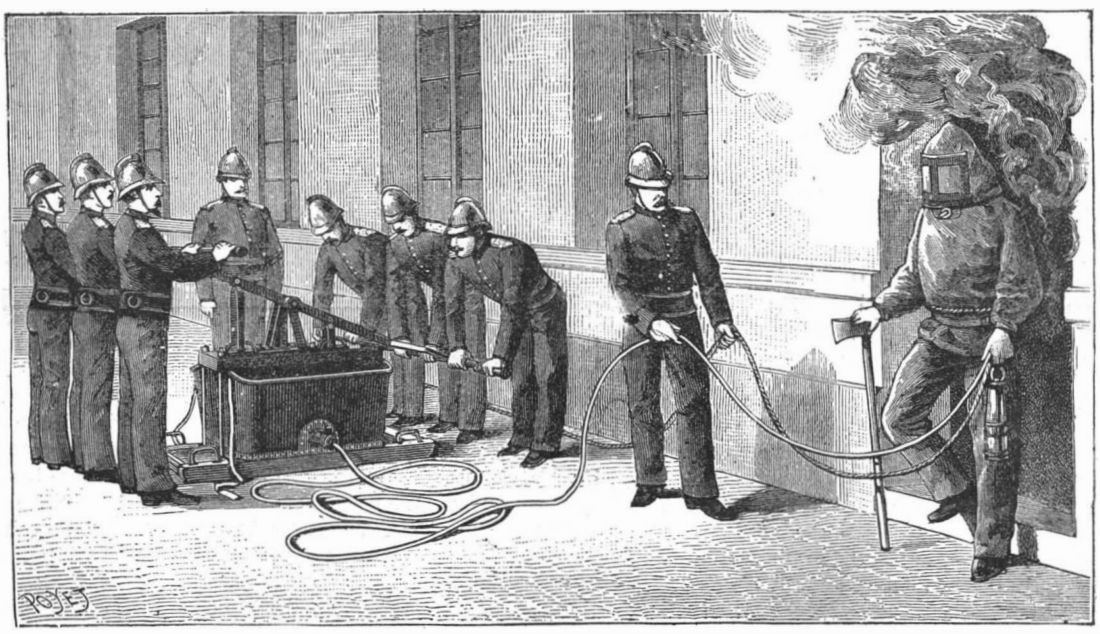

Fig. 2.—AIR PUMP AND FIREPROOF SUIT.

A CORRESPONDENT of the *Electrical Review* (London) furnishes the following table of the number of amperes required to fuse copper wires of various sizes:

B. W. G.	Amps.	B. W. G.	Amps.
30	21·84	36	7·72
32	19·25	40	4·58
34	15·44		

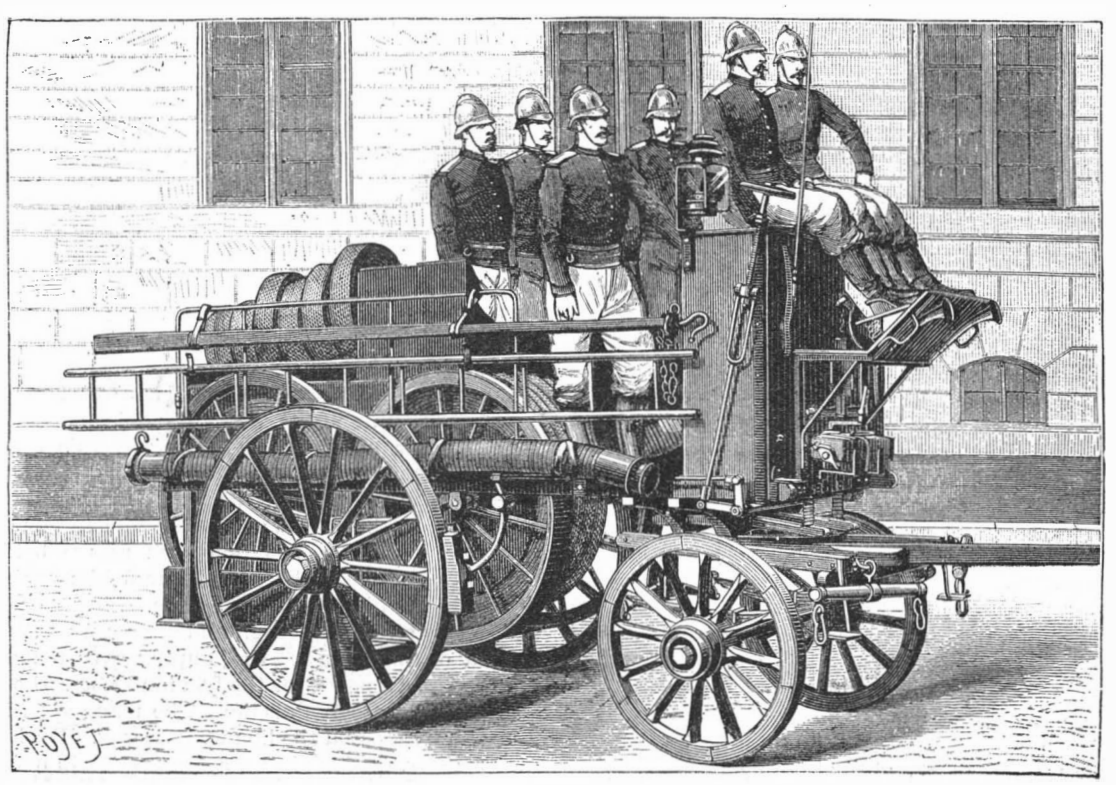

Fig. 1.—FIRE ENGINE TENDER.

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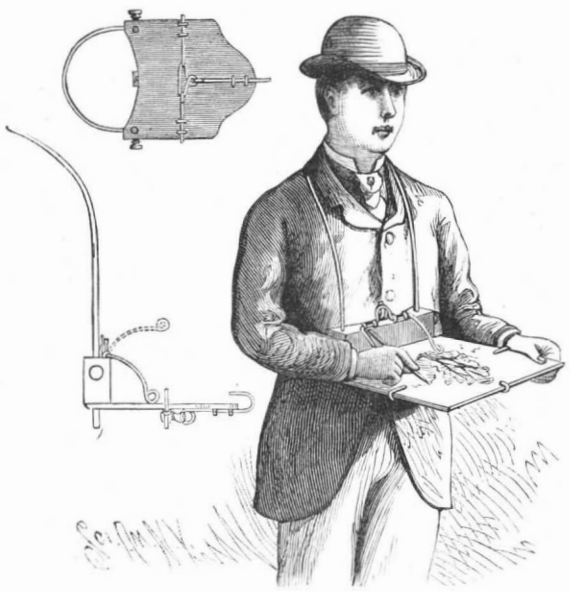
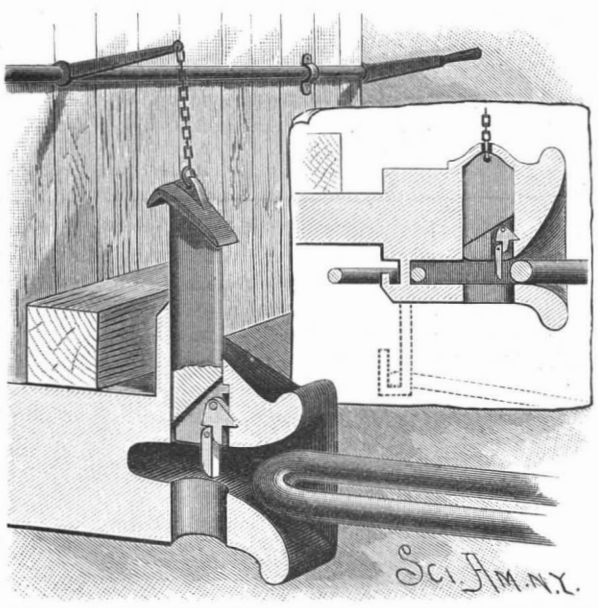
A CONVENIENT SKETCHING BOARD OR BOOK REST.

A simple device intended to facilitate reading while standing or walking about, or for writing, taking notes, or sketching, has been patented by Mr. Wilson Small, of No. 336 Lorimer Street, Brooklyn, N. Y., and is illustrated herewith, the small figures showing a



SMALL'S SKETCHING BOARD.

side elevation and an inverted plan view of the device. The support or table has a block or flange at the rear edge, which, with the adjacent edge of the table, is made concave, to fit against the body of the user, the table being connected to a yoke consisting of a small rod of iron bent in U form and curved backward, to fit over the neck and shoulders of the user. The lower ends of the yoke pass through small orifices near the ends of the block or flange, and in the ends of the block are set screws for locking the table high or low upon the yoke. For holding paper or the leaves of a book on the table, wire arms are pivoted to the upper edge of the block



BYRNE'S CAR COUPLING.

or flange, the arms being acted upon by a spring secured to the flange which bears against a central extension of the wire forming the arms. Side hooks and a front hook are attached to the bottom of the table, and adapted to move longitudinally, being drawn toward the center by a spring, preferably of rubber, the hooked ends reaching above the table to confine the paper or the leaves of a book.

AN IMPROVED CAR COUPLING.

A car coupling device in which the coupling pin has a hinged catch, on which is pivoted an arm, which, with the catch, can be folded into a recess in the pin, and which is designed to be simple and durable, while being automatic in operation, is shown in the accompanying illustration, and has been patented by Mr. Samuel Byrne, of No. 197 McCaul Street, Toronto, Canada. The drawhead has a flange on top serving as a protection to the pin from contact with the dead wood, its front end being so formed as to protect the gravity pawl of the pin from snow and ice. The pin is elliptical in form, with a corresponding aperture in flange and drawhead, and has a recess in its lower part in which is pivoted a gravity catch, adapted to engage a rest in the proper position in the drawhead. On the lower free end of the gravity catch is pivoted an arm having on its upper end a shoulder which engages a projection on the front part of the gravity catch, preventing the arm from swinging to the rear, but permitting its forward swinging motion. When the coupling pin is drawn up, the gravity catch swings forward and its shoulder swings into the rest, whereby the pin is suspended in vertical position, the pivoted arm extending downward, and its lower end reaching to within a short distance of the bottom of the drawhead.

As the link passes into the drawhead, its entering end strikes the pivoted arm and disengages the catch, so that the coupling pin drops down, causing the arm and gravity catch to swing out of the way, until the coupling is effected, when they drop down into their former position for uncoupling and resetting. The elevating of the pin is readily effected by means of a rod journaled across the end of the car, carrying an arm with a suitable short chain and hand lever, or by proper connection from the car roof. In the small figure is shown another form of construction, wherein there are two fixed pins, one of which will be always in the link, preventing its loss, the other being a stop to prevent the link retreating when entering an approaching drawhead, and having a space above it sufficient to allow the link to pass over and hang behind when not required.

Beet Sugar at Two Cents a Pound.

We have some interesting figures from Germany, showing at what price sugar is now being manufactured in sixty-four first class factories, as reported by the association of Oderbruch and Pomerania. To think that it is possible by existing improved appliances to extract 11·31 per cent sugar from the beet, and an additional 0·65 per cent from the molasses, or a total of 11·96 pounds per 100 pounds of beets, is calculated to cause a thrill of satisfaction in the breasts of Americans who contend for the best welfare of their country. The cost of this sugar was *only two cents per pound.* These, however, are actual facts, and could, with very little additional expense, be repeated in the United States. Unlike sorghum sugar, of an unknown future, this beet sugar is placed on the European market in quantities sufficient for the entire American consumption. We only have to follow the example given us, to become the *masters* and not the slaves of the world's sugar trade. Why these great opportunities are neglected remains a mystery to those who have the country's industries truly at heart.—*The Sugar Beet.*

AN IMPROVED COTTON STALK CUTTER.

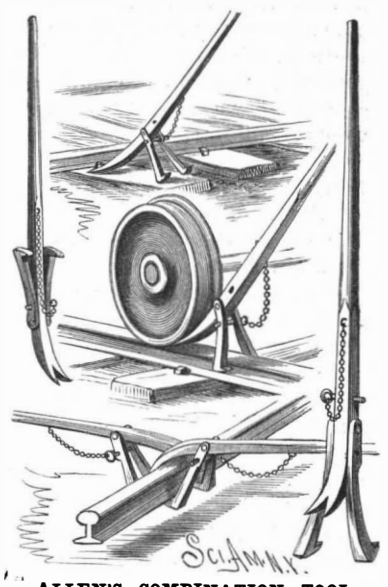
A machine adapted to cut down the stalks or plants left standing after harvest, and whereby the stalks are cut and severed in such way that they may be easily plowed under in preparing the land for the next crop, is shown in the accompanying illustration, and has been patented by Mr. John P. Lockwood, of the Wando Phosphate Co., Charleston, S. C.

The sulky on which the rearwardly extending stalk cutting mechanism is supported has short axles, on which the wheels are journaled, the axles extending far enough inside the sulky frame to allow levers to be fulcrumed on them. To the back end of each of these levers is journaled a shaft carrying a toothed pinion which meshes with an internal gear wheel or circular rack fixed to the inner face of the adjacent sulky wheel. To each of the shafts is fixed a cutter-holding frame, made preferably of two long and two short bars crossed at the center, where they are fixed to the shaft, each of the bars carrying at each end a laterally projecting cutter, which as the frame rotates cuts the standing stalks. The cutters not only sever the plants at a point about four to six inches from the ground, but, from the arrangement of the cutters on the longer and shorter bars, the severed stalks are cut into comparatively short pieces, which, with the short stumps left standing, may be easily plowed under when preparing the land for the next planting. The long arms of the levers carrying the cutter-holding frame, and fulcrumed upon the sulky wheel axles, extend forward to opposite sides of the driver's seat, where they are provided with foot plates, which, when depressed, will raise the cutter frames and cutters, either at one or both sides of the machine, as may be required, to avoid projections in the field, as rocks or stumps, the raising of the cutter frames and cutters not ungearing them from the sulky wheel gear.

LOCKWOOD'S COTTON STALK CUTTER.

AN IMPROVED COMBINATION TOOL.

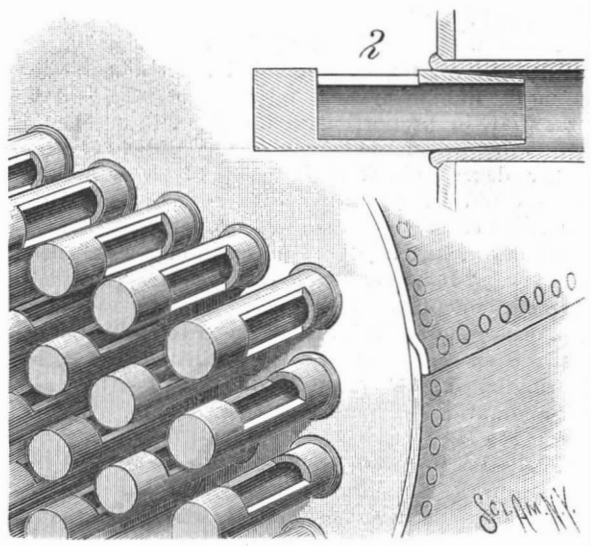
A tool which can be effectively used either as a cant bar, pry bar, pinch bar, spike claw, or rail lifter is illustrated herewith, and has been patented by Mr. William W. Allen, of No. 1126 Tyler Street, Topeka, Kansas. The tool consists of a claw bar with the usual claws, with dogs pivoted on each side of the bar on a pivot common to both, the dogs being each flared outwardly and slightly beveled on their inner edge, and having their front edge curved to prevent them being pushed off of a close grip. The dogs also have transverse apertures through which can be passed a pin to hold them in a locked position when not in use, the pin being hung on a chain, while to the outer end of each dog is secured a forwardly and slightly downwardly extending hook.



ALLEN'S COMBINATION TOOL.

AN ANTI-CLOGGING BOILER FLUE PLUG.

A boiler flue attachment which is designed to prevent dust, sparks, or unconsumed portions of the fuel from entering the flues is represented in the accompanying illustration, and has been patented by Mr. John Kelly, 24 Ann St., Los Angeles, Cal. It consists of a plug, preferably slightly tapered at one end, provided with a central recess opening into the boiler flue, and an opening through the wall of the plug communi-



KELLY'S BOILER FLUE ATTACHMENT.

cating with such central recess. The plug is driven with its tapering end into the front end of each of the boiler flues, the outer openings in the plugs being turned to the sides in the top row of flues, and upward in the following rows. The plugs are thus arranged so that the dust and cinders thrown up against the crown sheet, on being downwardly deflected, will, on striking the top row of plugs, fall again into the fuel, the next rows of plugs having their upwardly turned openings partially protected by the top rows, to prevent cinders from being drawn into them. The outward opening in each plug is to be made of about the same area as the cross section of a flue.

Frogs in Commerce.

Almost all the frogs used for experiments in vivisection in the European universities are supplied by an old fisherman of Kopenich, who, for forty-five years past, has devoted himself to this pursuit. Sometimes he has succeeded in catching as many as a thousand in one night. The traffic must be quite profitable, as the frogs sell for an average of two to four cents apiece.—*Period. Espan.*

A ROADBED OF SALT.—In the Colorado desert, near Idaho, there is a large bed of rock salt, and the Southern Pacific Railroad, in laying the track to the salt bed, has been obliged to grade the road for 1,200 feet with blocks of these crystals. This is the only instance where the roadbed is laid and ballasted on salt. The sea, which once rolled over this place, dried up and left a vast bed of salt nearly fifty miles long. The supply is inexhaustible and the quality excellent.

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Professor Horsley on Alcohol.

Professor Victor Horsley, F.R.S., F.R.C.S., speaking on the subject of temperance at the recent annual meeting of the Church of England Temperance Society, said that although he was unable to pose as a Nestor, and review the history of the temperance question from the medical point of view, yet he asked to be allowed for a moment to assume that part, and give a kind of apologia for the past position of the medical profession. Medical science, unfortunately, from the very nature of her general knowledge, was necessarily still in the chains of empiricism. It was thus bound, in common humanity, to receive the statements of any one based upon fair evidence, and to try and test the results which such a one might claim to have obtained from his own experience. It was in this way that the medical profession became enamored of alcohol as a drug, more especially in the treatment of acute disease and fevers.

The example and experience of the late Dr. Todd appeared to have great weight. Unfortunately, to his writings was due the universal employment of alcohol by the medical profession. Things had greatly changed. Physiological science had advanced immensely. They were now gradually freeing themselves from the slavery to which they were before subject, and that they knew that position of alcohol, from the medical point of view, had to be considered in the two opposite conditions of a food and of a drug. Researches of men like Parkes, who headed the movement, had given the medical profession the true scientific value of alcohol, and the value they knew to be very nearly zero. He should substantiate from clinical experiences what he was about to say.

With regard to alcohol as food, he reminded his hearers of a certain symposium that was written in the *Contemporary Review* in 1879. In the most brilliant of papers contributed by the medical profession, that by Sir James Paget, their most revered teacher in surgery, reference was made to the popular belief that, as the drinking of alcohol existed as a general custom, it was a good thing. Dr. Parkes, twenty-five years ago, pointed out that because one thing was a custom it was no evidence of the truth. Cannibalism was a custom in some parts of the world, and was it therefore good?

There was one scientific point ascertained beyond all doubt with regard to alcohol in its first influence upon the human system and animal body, and that was that, in proportion to the dose, it checked the tissue changes of the body. Alcohol did, in greater or lesser degree, check the activity of these processes. This could be produced with even a small dose. Carried to a greater extreme, its effect was not that of a regulator, but it proved an extra blocker of the machinery. "It seems," said the speaker, "a kind of chronic suicide that they were always to put the brake on—to put the brake on the development of their natural energies. What they wished to do without infringing the laws of nature was to get the greatest amount of energy out of their bodies. Why hinder it?"

Professor Horsley alluded to the series of experiments on the influence of alcohol upon plant life carried out by Dr. Ridge, of Enfield, who found that one sixteenth per cent of a solution of alcohol checked the growth of watercress, and that a tenth solution of alcohol killed its seeds. The position of the medical profession with regard to alcohol as a food was becoming more and more defined.

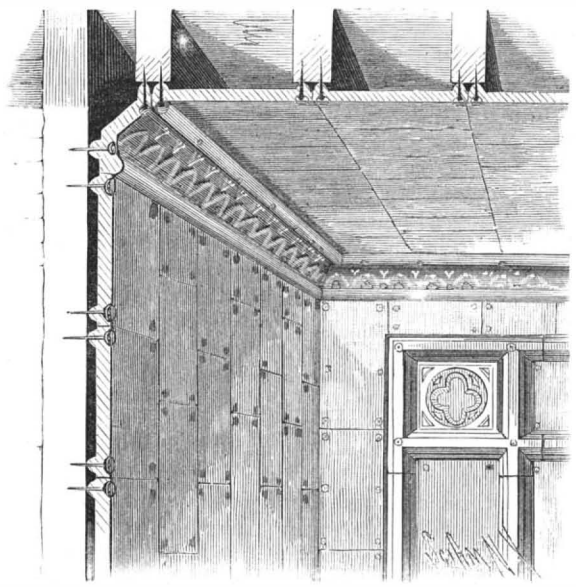
Professor Horsley next drew attention to the researches of Dr. Hare as to the use of alcohol as a medicine, and to the fact noticed by him—the large decrease in the use of alcohol at the London hospitals and the largely increased use of milk and other forms of nutrition. They had a large amount of evidence to show that the medical profession estimated at its full value alcohol as a drug. Referring to the London Temperance Hospital, where, since 1873, the experiment as to whether alcohol was useful had been tried to the uttermost, the evidence was perfectly wonderful to those who, like himself, used alcohol occasionally as a drug. It is true that they required even yet more statistics and more figures in the profession, and must wait before receiving the statistics as those upon which they would absolutely rely in the treatment of patients; but the result so far gained was so wonderful and so overwhelmingly contradictory to many preconceived notions, that he had no doubt as to what the verdict would be in the half jubilee of the Temperance Hospital.

In this hospital, which had admitted 4,153 persons as in-patients and 23,000 as out-patients, alcohol had only been administered as a drug in four cases. Dr. Edmunds, the senior physician, writing in 1884, stated that among fifty-three typhoid fever cases there had been five deaths, and at the examination it was found that no administration of alcohol could have possibly saved them. The cases of recovery had done remarkably well, and on the whole there was a mortality of rather less than 1 in 10. This mortality was smaller than the mortality in any other hospital in London at that period, and there had not been given to one of these a particle of alcohol either as diet or medicine, and yet a large number ought to have died, according to the old view of the treatment of the disease.

Figures spoke for themselves, but it seemed to him the use of alcohol as a food and its excessive abuse were dependent upon what must be regarded as possible from the view of causes which led to its abuse. The abuse of alcohol was produced from three groups of causes: From mental and moral failure of strength; secondly, from the general prevalence of unsanitary conditions; and, lastly, from the unjust and wicked facilities for getting the poison.—*British Medical Journal.*

IMPROVED CONSTRUCTION OF BUILDINGS.

An invention which presents some novel features in the construction of buildings, whereby thorough ventilation and increased security against fire are obtained, together with great durability and economy, is illustrated herewith, and has been patented by Mr. William Dryden, of No. 106 Hopkinson Avenue, Brooklyn, N. Y. To the sides of the wall studding and to the under side of the floor studding are directly fastened an improved form of building blocks, taking the place of the usual laths and brown coat of plaster. The composition of these blocks may be of any of the usual plastering compounds, but it preferably consists of whiting, plaster, glue, straw pulp, and alum. The block is formed with vertical depressions on one side and corresponding spherical projections on the other side, the projections resting against the joists to leave an air space, the blocks being secured in place by nails driven centrally through the depressions, the nail heads resting against washers, and the depressions formed in the face of the blocks serving to hold the plaster coats firmly thereto. The air space thus left extends continuously around and between the walls of adjoining rooms on the same floor, and between the ceiling and flooring of rooms over each other, the ceiling space of each room being connected by a registered opening with the usual chimney flue. An opening is formed centrally in the ceiling of the room, a circular block being arranged beneath it, so as to leave an annular passage for the air and gases from the room into the ceiling space, and openings are also formed in the blocks around the base of the wall for the entrance of cold air, all these openings being covered with wire gauze. By this construction a perfect and thorough ventilation of all the rooms in the building is readily obtained.



APPLICATION OF DRYDEN'S BUILDING BLOCK.

Army Boots and Shoes.

Captain Pope, prison quartermaster, says:

In accordance with my recommendation in last annual report, approved by the commandant and quartermaster-general, the welt machine has been gradually done away with, as the new facilities have admitted and as new hands have become trained, so that in this fiscal year all welts will be sewed by hand.

In May, 1886, a pair of cavalry boots were tap-soled (by putting a half sole over the ordinary sole, with brass screws going through the outer sole only), and sent to Captain A. R. Chaffee, Sixth Cavalry, in Arizona, for trial. It was found that they wore from May until the latter part of October. Complaint having been made that the boots and shoes failed to wear well in the Department of Arizona, on the recommendation of the commandant, all boots and shoes in said department were sent to the prison to be tap-soled, which has been done.

Certain boots and shoes, such as were worn in the late Apache campaigns, have been sent here for inspection. One pair of these were post shoes, which are only made for light garrison duty, and not intended for field service. Another pair were field shoes—a pattern discarded in 1885. Three pairs of cavalry boots were also sent. They were badly run down at the heels, and showed evidence of hard usage, which no boots could well endure.

Six pairs of new shoes were sent from Arizona as samples of shoes worn by the troops in the field. Four pairs were issued to prisoners doing hard prison labor. They were, all but one pair, which were campaign shoes, of the old, discarded pattern of field shoes. One pair issued April 3, to No. 408, doing general outside work, were half-soled June 6, and are still in use. One pair of field shoes issued to No. 440, April 10, were half-soled June 4, and were worn out and thrown away July 10. One pair of field shoes issued to No. 399, April 10, doing quarry work—the hardest work on shoes that can be done—were half-soled June 16 and July 19, and are still in use, and one pair field shoes issued to No. 313, April 28, are still in use, and have not been repaired.

There have been made for trial shoes sewed with thread called "metalin," composed of strands of flax and brass, copper, or steel wire. These were found to endure so well that all boots and shoes are to have the outer seam stitched with this thread in future.

The Campbell Lockstitch Machine Company was permitted to set up a machine in the shop and stitched 1,000 pairs of shoes for trial. As far as tested the stitch is found durable and satisfactory, but the use of metalin thread, which is somewhat more easily sewed on the Goodyear & McKay stitcher, renders a change in machines undesirable.

There were also made 1,000 pairs brass-screwed post shoes for trial. As far as tested they have been found durable and likely to prove a great improvement on the sewed calfskin shoes. I believe these to be fully as durable for ordinary wear in garrison as sewed campaign shoes.

During the past year the manufacture of calfskin shoes was ordered discontinued as soon as the supply of calfskin now on hand should be exhausted.

I cannot refrain from expressing the conviction, acquired from much study of the subject and discussion with officers and soldiers, that the post shoes were the most desired shoes ever issued to the army, and their discontinuance will be generally regretted by officers and soldiers; that substituting brass screwing for sewing, they make as good and strong shoes for dress purposes as can be made at any reasonable price. The cost per pair of these brass-screwed, calfskin shoes is only $2.72.

The cost of the labor of prisoners at 50 cents per day is now charged into the price of boots and shoes, as with other articles, and credited to the prison. As the boots and shoes are bought and paid for by the soldier on his clothing account, this requires him to pay for the labor of the prisoners. On many considerations, it seems to me the soldier might be allowed the benefit of this labor without charge, and I, therefore, renew the recommendation, formerly made, that the charge for prisoners' labor be omitted in making up the price of boots and shoes.

Nitro-Glycerine Shells.

At Sandy Hook, recently, Serge D. Smolianinoff made experiments in firing nitro-glycerine from a 100 pound Parrot rifled gun, using eighteen pounds of service powder for a shot. The shells used were of about ninety-two pounds weight, and were charged with five pounds of nitro-glycerine each, and provided with the inventor's igniter. The gun was fixed in an ordinary cradle, and shots were directed against a fourteen inch thick target of wrought iron. Mr. Smolianinoff himself had to fill the shells with nitro-glycerine and place them in the gun.

Five officers of the Ordnance Department were present—Col. Mordecai, Major Farley, Capt. Greer, Capt. Morrison, and Lieut. Howard. The cannon was discharged by an electric primer. The officers present and Mr. Smolianinoff hid themselves in the fortress, about 300 yards distant from the gun. At the first firing the shell duly exploded on the impact of the target, making a depression about four inches deep, and displacing the target about three inches. Some fragments of the shell were scattered over the fortress, scaring those inside. The second shell exploded, made a crack in the target about fifteen inches long and a quarter of an inch wide, and broke two rivets, one three and a half inches and the other two and a half inches in diameter. The third shell also exploded, making an impression about five inches deep.

After three shots the target was found displaced about 18 inches and torn off from the wooden base to which it was fastened. Up to this time this target had stood all kinds of shots, even gelatine-filled shells. The inventor believes that if he could have had steel instead of iron shells, the target would have been blown to fragments. Only three shots were made, further experiments being prevented by darkness. The 18 pound charge of powder has developed, in the gun used, pressure about 25,000 pounds to a square inch, and giving the initial velocity of about 1,600 feet a second. With these three shots Mr. Smolianinoff has to his credit 327 shots, all of which are said to have been successful.

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Correspondence.

Oil-Burning Boilers—How to Start the Fire.

To the Editor of the Scientific American:

In your issue of October 22 you quote from *Iron* a description of the method of using oil for fuel in boilers; and it is there stated that the furnace is primarily started with coal until a sufficient steam pressure has been reached in the boiler to start the oil-burning apparatus. When a boiler or furnace has been properly arranged for burning oil, it is not fitted to burn any other kind of fuel. Hence the inconvenience of generating steam with other kinds of fuel is very marked, and can be obviated and much improved by connecting an air pump to be operated by hand. The pump can be connected either to the boiler or direct to the burner. I know of the former method being used satisfactorily. BEN. HILL.

Tiona, Pa.

Experiments on the Sense of Smell in Dogs.*

I once tried an experiment with a terrier of my own, which shows, better than anything that I have ever read, the almost supernatural capabilities of smell in dogs. On a bank holiday, when the Broad Walk in Regent's Park was swarming with people of all kinds, walking in all directions, I took my terrier (which I knew had a splendid nose, and could track me for miles) along the walk, and, when his attention was diverted by a strange dog, I suddenly made a number of zigzags across the Broad Walk, then stood on a seat, and watched the terrier. Finding I had not continued in the direction I was going when he left me, he went to the place where he had last seen me, and there, picking up my scent, tracked my footsteps over all the zigzags I had made, until he found me. Now, in order to do this, he had to distinguish my trail from at least a hundred others quite as fresh, and many thousands of others not so fresh, crossing it at all angles.†

The object of the experiments about to be described was that of ascertaining whether a dog, when thus distinguishing his master's trail, is guided by some distinctive smell attaching to his master's shoes, to any distinctive smell of his master's feet, or to both these differences combined.

I have a setter bitch, over which I have shot for eight years. Having a very good nose, she can track me over immense distances, and her devotion to me being very exclusive, she constituted an admirable subject for my experiments.

These consisted in allowing the bitch to be taken out of the kennel by some one to whom she was indifferent, who then led her to a prearranged spot from which the tracking was to begin. Of course this spot was always to leeward of the kennel, and the person who was to be tracked always walked so as to keep more or less to leeward of the starting point. The district—park lands surrounding a house—was an open one, presenting, however, numerous trees, shrubberies, walls, etc., behind which I could hide at a distance from the starting point, and so observe the animal during the whole course of each experiment. Sundry other precautions, which I need not wait to mention, were taken in order to insure that the bitch should have to depend on her sense of smell alone, and the following are the experiments which were tried:

1. I walked the grass lands for about a mile in my ordinary shooting boots. The instant she came to the starting point, the bitch broke away at her full speed, and, faithfully following my track, overtook me in a few minutes.

2. I set a man who was a stranger about the place to walk the park. Although repeatedly put upon his trail by my servant, the bitch showed no disposition to follow it.

3. I had the bitch taken into the gun room, where she saw me ready to start for shooting. I then left the gun room and went to another part of the house, while my gamekeeper left the house by the back door, walked a certain distance to leeward in the direction of some partridge ground, and then concealed himself. The bitch, who was now howling to follow me, was led to the back door by another servant. Quickly finding the trail of the gamekeeper, she tracked it for a few yards; but, finding that I had not been with him, she left his trail, and hunted about in all directions for mine, which, of course, was nowhere to be found.

4. I collected all the men about the place, and directed them to walk close behind one another in Indian file, each man taking care to place his feet in the footprints of his predecessor. In this procession, numbering twelve in all, I took the lead, while the gamekeeper brought up the rear. When we had walked two hundred yards, I turned to the right, followed by five of the men; and at the point where I had turned to the right, the seventh man turned to the left, followed by all the remainder. The two parties thus formed, after having walked in opposite directions for a considerable distance, concealed themselves, and the bitch was put upon the common track of the whole party before the point of divergence. Following this common track with rapidity, she at first overshot the point of divergence; but, quickly recovering it, without any hesitation chose the track which turned to the right. Yet in this case my footprints in the common track were overlaid by eleven others, and in the track to the right by five others. Moreover, as it was the gamekeeper who brought up the rear, and as in the absence of my trail she would always follow his, the fact of his scent being, so to speak, upper most in the series was shown in no way to disconcert the animal when following another familiar scent lowermost in the series.

5. I requested the stranger before mentioned to wear my shooting boots, and in them to walk the park to leeward of the kennel. When the bitch was led to this trail, she followed it with the eagerness wherewith she always followed mine.

6. I wore this stranger's boots, and walked the park as he had done. On being taken to this trail, the bitch could not be induced to follow it.

7. The stranger walked the park in bare feet. The bitch would not follow the trail.

8. I walked the park in bare feet. The bitch followed my trail; but in quite a different manner from that which she displayed when following the trail of my shooting boots. She was so much less eager, and therefore so much less rapid, that her manner was suggestive of great uncertainty whether or not she was on my track.

9. I walked the park in new shooting boots, which had never been worn by any one. The bitch wholly refused to take this trail.

10. I walked the park in my old shooting boots, but having one layer of brown paper glued to their soles and sides. The bitch was led along my track, but paid no attention to it till she came to a place where, as I had previously observed, a small portion of the brown paper first became worn away at one of my heels. Here she immediately recognized my trail, and speedily followed it up, although the surface of shoe leather which touched the ground was not more than a few square millimeters.

11. I walked in my stocking soles, trying first with new cotton socks. The bitch lazily followed the trail a short distance and then gave it up. I next tried woolen socks which I had worn all day, but the result was the same, and therefore quite different from that yielded by my shooting boots, while more resembling that which was yielded by my bare feet.

12. I began to walk in my ordinary shooting boots, and when I had gone fifty yards, I kicked them off and carried them with me, while I continued to walk another three hundred yards in my stocking soles; then I took off my stockings, and walked another three hundred yards on my bare feet. On being taken to the beginning of this trail, or where I had started in my shooting boots, the bitch as usual set off upon it at full speed, nor did she abate this speed throughout the whole distance. In other words, having been once started upon the familiar scent of my shooting boots, she seemed to entertain no doubt that the scent of the stocking soles and of the bare feet belonged to me; although she did not clearly recognize them as belonging to me when they were not continuations of a track made by my shooting boots (10 and 11).

13. I requested a gentleman who was calling at the house, and whom the bitch had never before seen, to accompany me in a conveyance along one of the carriage drives. At a distance of several hundred yards from the house I alighted in my shooting boots, walked fifty yards beside the carriage, again entered it, while my friend alighted and walked two hundred yards still further along the drive. The bitch ran the whole 250 yards at her full speed, without making any pause at the place where the scent changed. This experiment was subsequently repeated with other strangers, and with the same result.

14. I walked in my ordinary shooting boots, having previously soaked them in oil of aniseed. Although the odor of the aniseed was so strong that an hour afterward the path which I had followed was correctly traced by a friend, this odor did not appear to disconcert the bitch in following my trail, for she ran me down as quickly as usual. It was noticed, however, by the friend who took her to the trail that she did not set off upon it as instantaneously as usual. She began by examining the first three or four footsteps with care, and only then started off at full speed.

15. Lastly, I tried some experiments on the power which this bitch might display of recognizing my individual odor as emanating from my whole person. In a large potato field behind the house, a number of laborers had been engaged for eight or ten hours in digging up and carrying away potatoes all the way along half a dozen adjacent "drills." Consequently, there was here a strip of bared land in the field about twenty yards wide, and a quarter of a mile long, which had been thoroughly well trampled over by many strange feet. Down this strip of land I walked in a zigzag course from end to end. On reaching the bottom I turned out of the field, and again walked up a part of the way toward the house, but on the other side of a stone wall which bounded the field. This stone wall was breast high, and was situated nearly a hundred yards to windward of my previous course through the potatoes. The bitch, on being led out of the house, was put upon my trail at the top of the field, and at high speed picked out my trail among all the others, following roughly the various zigzags which I had taken. But the moment she gained the "wind's eye" of the place where I was standing behind the wall, she turned abruptly at a right angle, threw up her head, and came as straight as an arrow to the spot where I was watching her. Yet while watching her I had allowed only my eyes to come above the wall, so that she proved herself able to distinguish instantly the odor of the top of my head (without hat) at a distance of two hundred yards, although at the time she was surrounded by a number of overheated laborers.

16. On another day, when it was perfectly calm, I tried the experiment of standing in a deep dry ditch, with only the top of my uncovered head above the level of the surrounding fields. When she was led within two hundred yards of the place, she instantly perceived my odor, and ran in a straight line to where I had then ducked my head, so that she should receive no assistance from her sense of sight. This experiment shows that, in the absence of wind, the odor of my head (and no doubt, in a lesser degree, that of my body) had diffused itself through the air in all directions, and in an amount sufficient to enable the setter to recognize it as my odor at a distance of two hundred yards.

From the above experiments I conclude that this bitch distinguishes my trail from that of all others by the peculiar smell of my boots (1 to 6), and not by the peculiar smell of my feet (8 to 11). No doubt the smell which she recognizes as belonging distinctively to my trail is communicated to the boots by the exudations from my feet; but these exudations require to be combined with shoe leather before they are recognized by her. Probably, however, if I had always been accustomed to shoot without boots or stockings, she would have learnt to associate with me a trail made by my bare feet. The experiments further show that although a few square millimeters of the surface of one boot is amply sufficient to make a trail which the animal can recognize as mine, the scent is not able to penetrate a single layer of brown paper (10). Furthermore, it would appear that in following a trail this bitch is ready at any moment to be guided by inference as well as perception, but that the act of inference is instantaneous (12 and 13 as compared with 2, 8, and 11). Lastly, the experiments show that not only the feet (as these affect the boots) but likwise the whole body of a man exhales a peculiar or individual odor which a dog can recognize as that of his master amid a crowd of other persons (15); that the individual quality of this odor can be recognized at great distances to windward (15), or, in calm weather, at great distances in any direction (16); and that it does not admit of being overcome by the strong smell of aniseed (14) or by that of many other footprints (4).—*Nature.*

* Paper read by Mr. George J. Romanes before the Linnean Society, on December 16, 1886. Reprinted from the Linnean Society's *Journal*—Zoology, vol. xx.

† "Mental Evolution in Animals," pp. 92, 93; where also see for additional remarks of a general kind on the sense of smell in different animals.

The Motive Force of the World.

The Bureau of Statistics in Berlin has recently issued some interesting information in connection with this subject. Four-fifths of the engines now working in the world have been constructed during the last 25 years. France owns 49,590 stationary or locomotive boilers, 7,000 locomotives, and 1,850 boats' boilers; Germany has 59,000 boilers, 10,000 locomotives, and 1,700 ships' boilers; Austria, 12,000 boilers and 2,800 locomotives. The force equivalent to the working steam engines represents: In the United States, 7,500,000 horse power; in England, 7,000,000 horse power; in Germany, 4,500,000; in France, 3,000,000; and in Austria, 1,500,000. In these figures the motive power of the locomotives is not included, whose number in all the world amounts to 105,000, representing a total of 3,000,000 horse power. Adding this amount to the other powers, we obtain the total of 46,000,000 horse power. A steam horse power is equal to three actual horses' power; and a living horse is equal to seven men. The steam engines of the world represent, therefore, approximately the work of 1,000,000,000 men, or more than double the working population of the earth, whose total population amounts to 1,455,923,000 inhabitants. Steam has accordingly trebled man's working power, enabling him to economize his physical strength while attending to his intellectual development.

Windmill Power for a Printing Office.

Mr. Max Nicolaus, editor of the *Avalanche*, Sauk Center, Minn., sends us photographs of his printing office, in which he has two job presses run by a windmill—a fact that is exciting considerable attention in that section. Wind is an important agent in the running of political newspapers, especially about election time, but its employment in such prosaic service as doing useful commercial printing is, we believe, quite exceptional.

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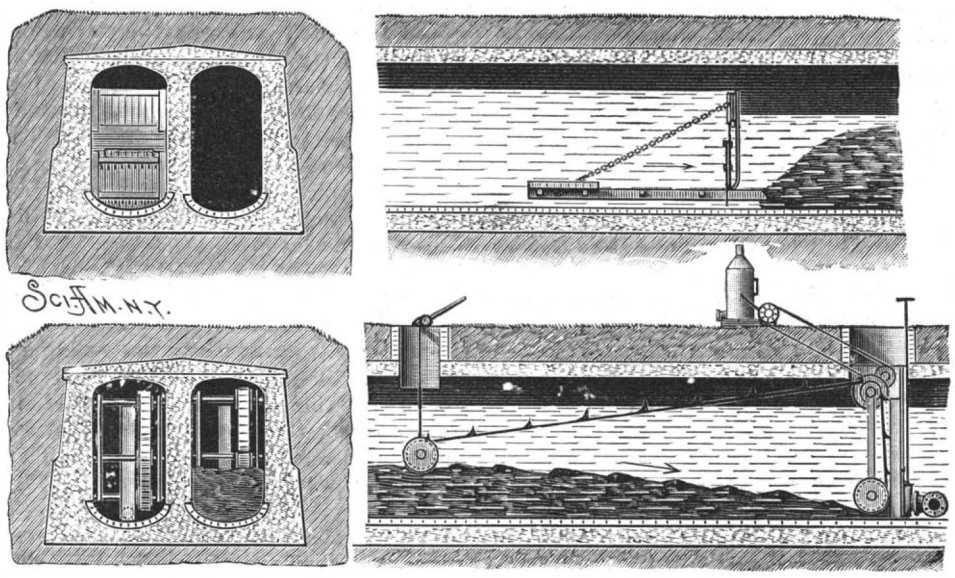
THE BOSTON SEWER SYSTEM AND MAIN DRAINAGE WORKS.

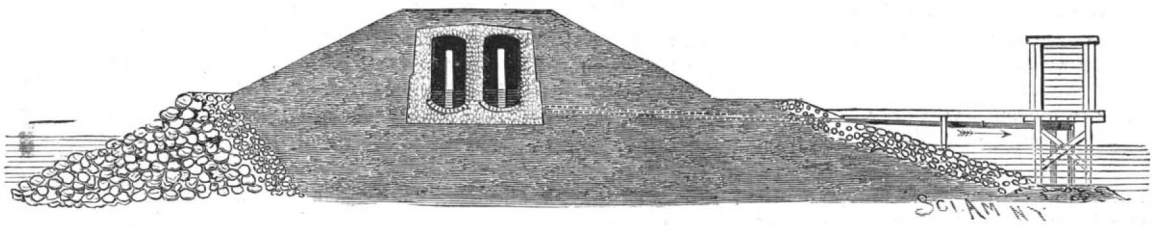
(*Continued from first page.*)

Boston, indicates the intercepting sewer. While it was constructed so as to cut off the discharge into the waters of the bay of all ordinary drainage, the old outlets were not completely closed. They are preserved, and, by means of dams or gates, are arranged to discharge all over a certain amount. This amount is made great enough to allow for all ordinary flow and for the lighter rain storms. In case of heavy falls of rain, the overflows come into action, and permit part of the water to run directly away into the bay.

From the city the transit lines run eastward, and reach eventually a low, marshy piece of land called the "calf pasture." Over this a causeway, marked Mt. Vernon Street on the map, has been built. Under its roadway the sewer runs for about a mile. At the end of this line the pumping station is established. Up to this point in the main and intercepting sewers, devoted to the city of Boston and environs, a length of 13½ miles is included. The diameter of the main line varies from 7½ to 10½ feet. Its mean descent is 1 in 2,500. The bottom of its delivery end at the pumping station is 14 feet below low water level.

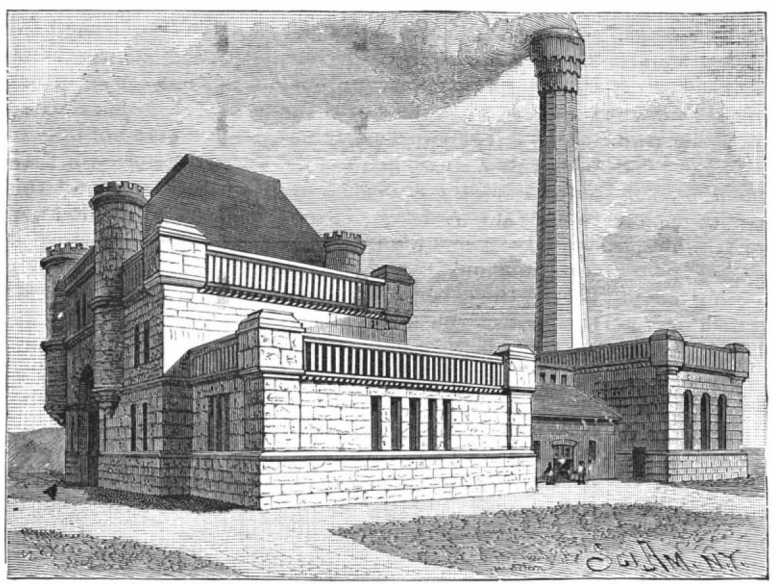


CHAIN FEEDER AND MOVABLE SCRAPER.



BOSTON DRAINAGE SYSTEM—DEPOSIT SEWERS.

The pumping station, of which we give an exterior and interior view, is a fine structure. It is built of granite, and in its architectural features is worthy of all commendation. Its general plan includes two wings, with a connecting building. One wing is devoted to coal storage, and from within it the large chimney rises. The capacity of the coal bins is 6,000 tons.



BOSTON DRAINAGE SYSTEM—PUMPING STATION BUILDING.

In the connecting building the boilers, four in number, are placed. Each pair is of 250 horse power, and can supply all the steam required in ordinary working. They are built of steel; each one has 45½ square feet grate surface and 1,826 square feet heating surface, giving a ratio of 40:1. Exhaustive tests of efficiency were made in the spring of 1885, showing an evaporative power of 10·43 lb. of water per pound of dry coal from water of the actual existing temperature; reducing to a commercial efficiency of about nine pounds. During these tests the boiler under trial was indicating from 112 to 134 horse power.

In the other wing are situated the pumping engines. These are divided into high duty and low duty engines. Of each class there are two, each engine having two cylinders.

On the first page of this paper we illustrate the great high duty pumping engines, designed by Mr. E. D. Leavitt, Jr. They are impressive structures, and present an imposing appearance, as the great flywheels ceaselessly rotate, and the engines quietly do their duty and dispose of the drainage from nearly ten square miles of territory.

They are compound beam engines. The pumping cylinders, of which there are two, are directly below and in line with the high and low pressure steam cylinders. The low pressure steam cylinder is situated at one extremity, the high pressure cylinder at the other extremity of the walking beam. This secures a very even disposition of the main working parts of the engine. The walking beam is pivoted at about the floor level. From one of its ends the pitman rises to the crank. The pitman end of the walking beam is provided with an oblique extension or horn of suitable angle to secure the best working of the connections. The fly wheel journal is nearly on a line with the lower heads of the steam cylinders. The leading dimensions of these engines are as follows:

Diameter of high pressure cylinder..		25½	in.
Diameter of low pressure cylinder....		52	"
Diameter of plunger...		48	"
Length of stroke.....	9 ft.		
Distance between centers of cylinders.	15 "	2	"
Radius of beam to end centers.....	8 "	3	"
Radius of crank.....	4 "		
Diameter of flywheel.....	36 "		
Weight of flywheel.....	36 tons.		

Nominal capacity of each engine, 25,000,000 gallons a day.

Speed for capacity.... 11 revolutions per minute.

They were tested at the same time with the boilers, and gave a very high efficiency. Each test extended over 24 hours' running. In one trial an indicated power of 251 H. P. was obtained, in the other 290 H. P. In sewage lifted with no allowance for slip of pumps (8·5 per cent to 4·6 per cent to be added), an actual power of 219·9 and 243·5 H. P. respectively was attained. Per indicated horse power an average of 1·34 pounds of coal was burned per hour. With new valves, the slip of the pumps reduces to 2·5 per cent. A portion of the steam was used to drive the feed water pump. Allowing for this, the duty of the pumping engine reduced to 122,500,000 foot pounds per hundred pounds of coal. This gives an extremely high efficiency, and speaks well for the design of the pumps. They were built by the Quintard Iron Works, and cost $115,000 each. The low duty engines were built by Henry R. Worthington & Co. They cost $45,000 each. The leading data for each one is as follows:

Nominal capacity..... 25,000,000 gallons a day.
Speed for capacity....12 double strokes per minute.
Diameter of high pressure cylinder.....21 in.
Diameter of expansion cylinder..... 36 "
Diameter of plunger..... 45 "
Length of stroke..... 4 ft.
Guaranteed duty, in foot pounds per 100 lb. of coal, 60,000,000.

They are of the well-known horizontal type of these makers, with a new style of hydraulic valve gear.

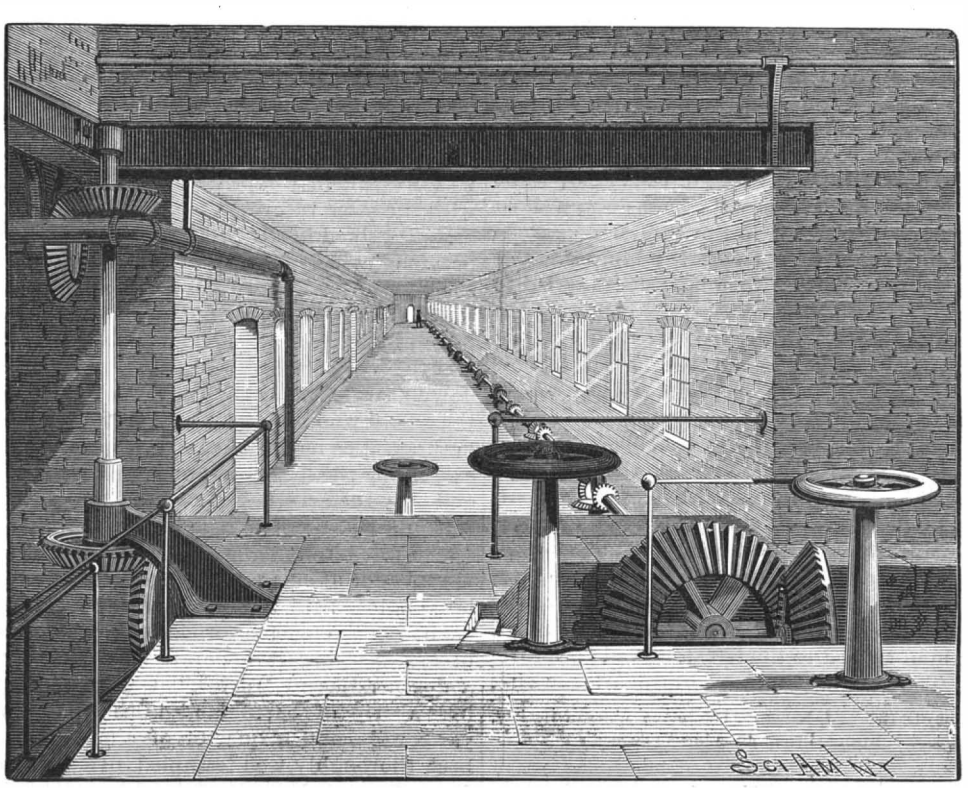
The pair of high duty engines cost $140,000 more than the pair of low duty engines. The total coal burned in 1886 cost $7,789.55. They cannot well be credited with a saving of over this amount during the year. Doing this, their saving will represent only a little over 5 per cent on their excess of cost over cheaper low duty engines. This is supplemented, of course, by a saving on boiler capacity; but the latter is of minor account. Hence they probably illustrate one of those cases in engineering where capitalization of improved apparatus is barely paid for by the increased economy effected. Still, every hydraulic engineer aims for high efficiency, and it seems only fitting that such a great city as Boston should have the most perfect engines that are procurable for money.

The low duty engines are used when a heavy rain sends a large volume of drainage to the station. The bulk of the work is done by the high duty engines.

The sewage is pumped out of the delivery sewer, first being screened through cages of one inch mesh. Here one or two cubic yards daily of material is arrested. It is collected from time to time, pressed in a hand press, and burned under the boilers.

From the pumps the screened sewage is delivered through mains four feet in diameter, one for each engine, to two parallel lines of deposit sewers. The latter are built of concrete masonry, forming a monolithic mass, and each one is 1,260 feet long, 8 feet wide, and 16 feet high.

Through them the liquid flows at a rate of about 3 inches per second. The fine material held in suspension is almost completely deposited in the first 600 feet. About midway of their length a twelve inch pipe enters them, from one side, connecting with vertical trunks. One trunk is in each sewer, with two gates near the lowest level. On opening one or the other of these gates, the lower layers of water rush out with high velocity, carrying with them the solid material that has accumulated. To assist in feeding it up to these trunks, a chain feeder is employed and also a movable scraper. Both are illustrated. The chain feeder, constructed on the principle of a chain pump or grain elevator, draws the material along to the mouth of the discharge pipe, which engulfs all that comes near it. The movable scraper consists of a dam or screen that approximately fits the sewer. An extension platform runs back from its base, and when the machine is in use, receives 4,800 pounds weight to keep the end



BOSTON DRAINAGE SYSTEM—GATE HOUSE AT MOON ISLAND.

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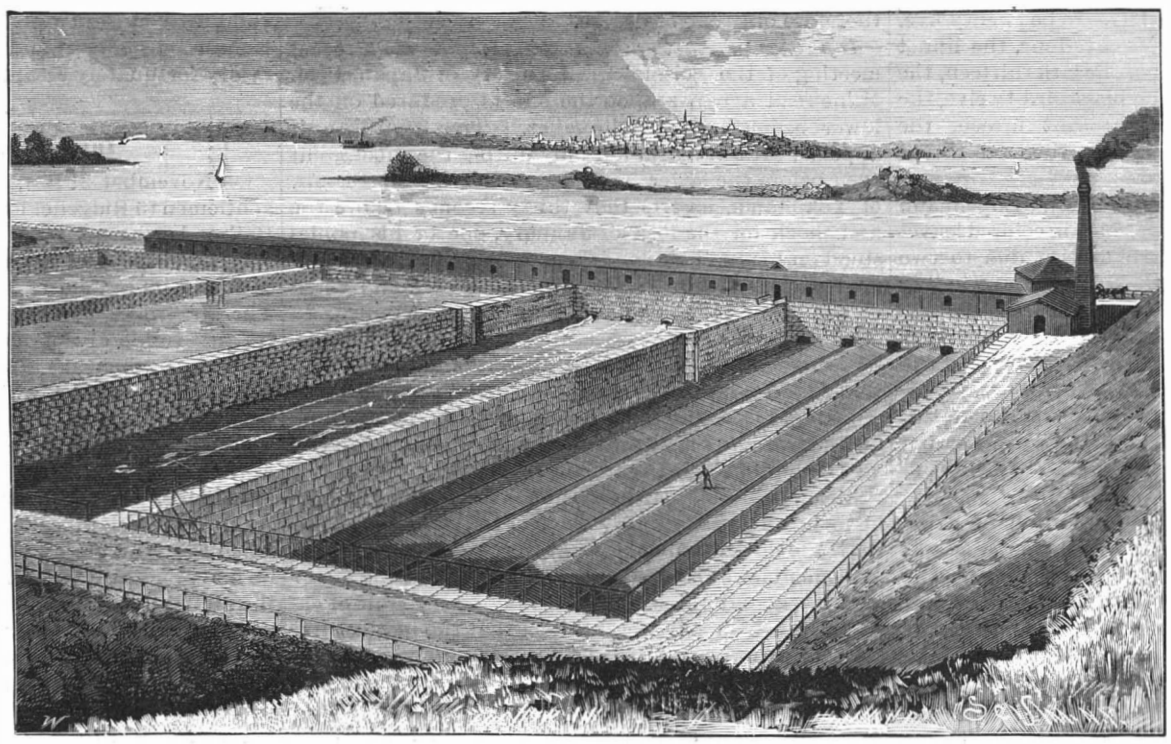
down. A chain holds the gate upright against the pressure of the water. This machine is put in position at the end of the sewer nearest the pumps and the sewage is turned in. It runs over the gate and also to some extent around and under it, pressing the scraper forward at the same time. The pressure and scouring action of the water work and force the deposit forward until it reaches the outlet trunk. To replace the scraper, the weights are removed and it is floated back.

The current through the outlet pipe is sufficient to carry a half brick with it, and sticks can even be carried by it around the bends. The sludge is delivered to a tank. As much water comes with it, this, after settling, is permitted to flow on and into the sewer again, beyond the deposit lines. The sludge is taken out to sea in a barge, and dumped into the water.

In 1886 the maximum daily amount pumped was 111,537,337 gallons, the average daily amount was 36,866,129 gallons. The cost for labor, fuel, repairs, and general expenses, no interest or depreciation being included, was for 1886, $29,168.34. The lift varies from 35 to 45 feet, and the cost per million gallons lifted one foot is put at $0.059, or about six cents. Some seven or eight cubic yards of sludge are collected daily from the deposit sewers. The sewage, now almost clean water, is carried through a 7½ foot sewer, 7,160 feet long, across Dorchester Bay, then through a temporary flume, 11 feet high and 12 feet wide and about 6,000 feet long, to the reservoirs on Moon Island. Here it is collected and impounded. These reservoirs cover 5 acres. Their floor is 1 foot below high water mark, and their walls are 16 feet high. Their capacity is 25,000,000 gallons. About one hour after high tide, the outlet gates are opened, the nearly clear drainage rushes out, and in forty minutes they are emptied. The drainage is then allowed to accumulate for another tide.

The gates are worked by a long shaft, nearly 600 feet long, that carries bevel cog wheels in pairs, one pair for each gate. By setting these, the shaft, though revolving in one direction, can be made to either open or shut the valves. The shaft is driven by a turbine wheel, which is turned itself by the drainage water, a portion of which is diverted for this purpose. A steam plant is provided also for use when the turbine is laid up. The bottoms of the reservoirs are shaped so as to favor perfect drainage. To flush them, drainage is allowed simultaneously to enter at one corner and flow out at the other. This scours them perfectly, leaving the masonry bare and clean. Samples of the fluid collected here are as clean as rain water, except for a slight deposit. The fluid has quite a strong odor, however. The men in charge make no complaint, and their health seems perfect. The flume leading from Squantum to Moon Island, and which we have referred to as only temporary, is carried by a new embankment. When this shall have settled and reached a definite level, a permanent masonry structure will be built and the system will then be complete.



BOSTON DRAINAGE SYSTEM—RESERVOIRS AT MOON ISLAND.

NEWS comes from Prescott, Arizona, of the discovery of a wonderfully rich ledge of gold bearing rock 20 inches wide, on the Hassayampa River. The assay shows $100,000 per ton. The pieces of the rock, when broken, hang together by the gold in them.

Electrical Notes.

Role of Electricity in the Production of Hail.—An endeavor has often been made to bring in electricity as one of the determining causes of the formation of hail, through the more rapid cooling that electrified liquids undergo—an effect that was pointed out a long time ago by (among others) Abbot Nollet and Guyten de Morveau.

Mr. Govi has taken up these experiments, and has demonstrated that the electrification of even a liquid cannot produce such an effect. In order that such effect be produced, it is necessary that, through the action of the neighboring points of the surface, an electrical wind shall occur, which then, in renewing the strata of air in contact with the liquid, shall hasten the evaporation, and consequently the cooling of the liquid.

The electrified drops of water of the clouds can evidently do nothing of the kind, and electricity, therefore, cannot play the part that has sometimes been assigned to it.

Decomposition of Water by Electricity.—The same physicist has recently performed a curious experiment that permits of rendering very perceptible the decomposition of water by the electricity of ordinary machines or the induction apparatus of Belli, Holtz, Wimshurst, and others, without having recourse to the exceedingly fine gold or platinum wires used for this purpose by Wollaston in 1801. It is simply a question of preserving the acidulated water of a voltameter from atmospheric pressure. The two gases are observed to disengage themselves in abundance from the platinum wires as soon as the latter are connected with the positive and negative sources of electricity whose chemical action it is desired to demonstrate. The use of a battery permits the phenomenon to be rendered visible to a large audience.

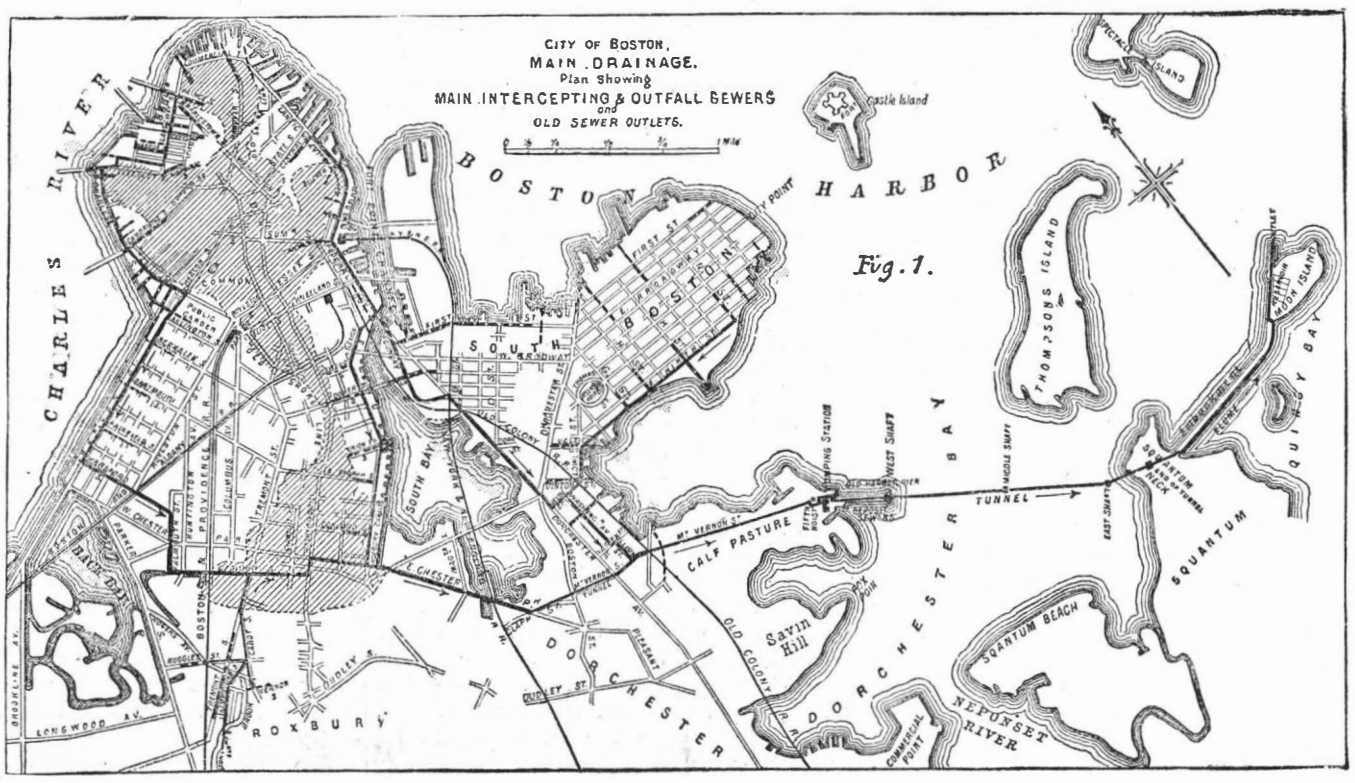
Electro-metallurgic Deposit of Aluminum.—Mr. H. Reinbold gives the following process: Prepare a bath containing 50 parts of alum (potassic) to 300 of water, add 10 parts of chloride of aluminum, heat to 100° C., and then allow to cool. After this add 39 parts of cyanide of potassium to the solution.

The object to be plated, after being properly cleaned, as in the processes of gilding, etc., is suspended in the bath from the positive electrode, and a plate of aluminum is used as a negative electrode. The current should be quite feeble.

After being polished the deposited metal will be exceedingly brilliant, more so even than silver.

Joints of Electrical Conductors.—When the extremities of copper conductors are joined by simply twisting the wires around each other, it is not rare to see a slight deposit of oxide form, which increases the resistance.

Mr. Matignon, of Eynesse, secures a perfect contact of the wires by depositing, through electrolysis, a layer of copper at the point of contact, and covering the whole with an insulating substance.



Protecting Iron against Rust.

It is well known that this long-standing evil of paint and composition peeling off has more particularly manifested itself of late in consequence of the substitution of steel for iron plates, all new vessels invariably throwing off their first coat. This may in part be attributed to the smooth surface of the plates and in part to the existence of a "bloom" on their surface, which after a short time detaches itself and falls off, carrying the paint with it, and so exposing large portions of the plates to the deleterious action of the salt water. This is aided by the continuous chafing between wind and water caused by lighters and quay walls, and in the bows by the anchor chains, whereby large surfaces of paint are removed and much rusting results.

The Admiralty and a few private ship-owning firms have attempted to overcome this lack of adhesion between plate and paint by pickling the plates in a weak solution of hydrochloric acid before riveting them on the frames, thus removing the "bloom" and producing a slightly porous surface on which the paint can get a readier hold. This process, in addition to its expense, requires very careful handling, as an appreciable amount of metal is lost if the plates remain too long in the acid, while even under most favorable conditions the surface produced is not sufficiently rough to secure the adhesion of the paint when subjected to outside chafing. It has been reserved to Messrs. Holzapfel & Co. to devise a thoroughly practical and, at the same time, simple and inexpensive method of surmounting this difficulty, their plan consisting in simply rough-rolling all the plates to be used in the construction of a vessel. This is done at the rolling mills, where the rolls, instead of having smooth, cylindrical surfaces, are formed so that their rolling faces somewhat resemble a fine file, corresponding indentations being of course formed in the plates as they pass between them.

By having the surface of the iron roughened in this manner, the minimum of scale would be formed, while the paint, which could be applied at once, would find a suitable surface for permanent adhesion. Again, when chafed, the injury would be localized by the roughening, and only a very small quantity of paint being displaced, the consequent rusting would be insignificant.

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Natural History Notes.

The Longevity of Birds.—The human race is not the only one that has the privilege of furnishing centenarians. There are several birds that have the pretension to easily reach the age that Mr. Chevreul has attained. Among the canditates for the prize of longevity, says the *Eleveur*, must be cited the eagle, the swan, and the raven, which live for over a century. The perroquet, as well as the heron, is content to become a sexagenarian. The sparrowhawk lives to the age of forty, which is the age likewise reached by the duck and pelican. The pea fowl lives to be twenty-five, the pigeon twenty, the crane twenty-four, the linnet twenty-five, the goldfinch fifteen, the lark thirteen, the black-headed warbler fifteen, the blackbird twelve, the canary bird twenty-four, the pheasant fifteen, the thrush ten, the domestic cock ten, the red throat twelve, and the wren three.

The Color of Colored Leaves.—Dr. T. W. Engelmann has investigated the cause of the color in colored leaves where the coloring is normal. He finds it due to two different causes: a variation in the color of the assimilating chlorophyl grains and the occurrence in the leaf of special pigments in addition to the normal chlorophyl. In the first case the coloring matter appears to be invariably of a light shade, and either pure yellow or yellow-green, with every transition between this and ordinary chlorophyl green. In the second case it is usually red-brown, dark purple-brown, purple-red, or violet.

In the first group of cases the proportion of coloring substance is often nearly uniform in the same species. In the yellow variety of the elder the tint does not appear to be due to a pure xanthophyl, but to a mixture of chlorophylan with a small quantity of true chlorophyl. In more refrangible light (about $\lambda = 0{\cdot}53\ \mu$) the yellow cells decompose relatively, if not absolutely, more carbon dioxide than the green cells do; while in red and green light the green cells decompose, both relatively and absolutely, more than the yellow.

In the second group the seat of the pigment is usually the cell sap, less often the cell wall. In the latter case the coloring is mostly confined to small portions of the surface, causing variegated leaves, as in the zonal pelargoniums. Of leaves colored by soluble pigments, Dr. Engelmann has examined about fifty kinds. These may be divided into two sections, connected with one another by intermediate forms: those in which the leaves are normally colored during the whole or the greater part of their existence and those which are colored only when young. In both these cases the coloring is usually, but not always, spread over the whole surface of the leaf. That cells containing a purple sap can decompose carbon dioxide as energetically as those which contain pure chlorophyl is shown by the vigor exhibited by the copper beech, the various species of *Coleus*, etc.

Effect of an Eclipse on Birds.—The last eclipse of the sun seems to have produced more effect upon animals than upon man. *La Nature* says that, at Berlin, birds that were in full song at sunrise suddenly became silent, and, when the darkness was deepest, showed their inquietude by cries of fear. It was remarked by observers that perroquets were the most alarmed, while canary birds appeared to be the most indifferent to the astronomical phenomenon.

Bobolinks.—The bobolink is a favorite field songster in our Northern States, but when he goes southward he changes his name to "reed bird" and "rice bird," and puts on a most rapacious, vicious, and destructive character. In turn, he becomes the target of pot-hunters, by whom millions are destroyed for table use. The bobolink, transferred to the South, lives daintily on the rice fields, and this industry is actually crippled by these birds, which appear in innumerable hosts at seed planting and again at harvest time. No one would imagine that our well favored "Robert o' Lincoln" comes to us from a most fearful raid on rice, and departs from us with the same evil intent. The rice crop by the last census was valued at $6,607,000, the product being 110,000,000 pounds. The loss by the rice birds is estimated at $2,000,000 annually. Thousands of men and boys are employed to shoot these trespassers, and the rice fields are shadowed by a "sulphurous canopy," as if some grand battle was in progress. The last report of the Commissioner of Agriculture has some startling facts in regard to the ravages of these birds. The rice planters are in despair. Individual losses are often fifty per cent of the crop, and from five to ten dollars an acre is not uncommon. The flight of these birds is always in the night. They appear in the spring in the last half of April, and return punctually in South Carolina on the 21st of August and the two or three days following.

Stipules.—A lengthy research on the nature and origin of stipules is given by Mr. G. Colomb, in the *Annales des Sciences Naturelles.* He considers that various organs, such as the spines of *Xanthium spinosum* and of the orange tree, and the tendrils of sarsaparilla, have been considered on too slight grounds to represent stipules. Having examined the structure of the stipular organs of various plants, he has been led to the conclusion that the name of stipule should be limited to any appendage inserted on the stem of which the vascular system is exclusively formed of branches of the vascular bundles passing into the petiole. He regards the stipule as forming a portion of a ligule. The ligule he defines as consisting of three parts, viz., sheathing, axillary, and stipular portions. When the stipular portions exist only, these are to be considered as stipules; when the axillary portion is also present, the term axillary stipule may be used; and when the sheathing portion is also present, the name of ligule in applied. The difference in structure of the ligule and stipule is therefore only one of degree.

Influence of Earthquakes on Animals.—At a recent meeting of the Seismological Society of Japan, Prof. Milne read a paper upon the effects produced on the lower animals by earthquakes. The creatures, it appears, exhibit alarm not only during the shocks, but even before the latter have been felt. Mr. J. Bissett, of Yokohama, asserts that thirty seconds before the first shock on the 15th of January, one of his ponies stood on his hind legs and kept rearing in his stall, an evident prey to terror. Another pony at Tokio acted in the same way. The professor had ascertained, on several occasions, that pheasants utter cries of fear before earthquakes, and several observers had told him that under such circumstances frogs suddenly cease croaking. Of all animals, it is said that geese, swine, and dogs are the ones that announce the approach of an earthquake most markedly. Several birds exhibit restlessness, hide their heads under their wings, and behave in an extraordinary way. Prof. Milne supposes that the lower animals must recognize very feeble movements that escape man. He thinks that the terror that intelligent animals exhibit may be the fruit of experience, which has taught them that the lightest tremors are the prelude to more alarming movements. These slight tremors serve to explain the restlessness of pheasants, geese, and frogs. As for the strange uneasiness exhibited by animals several hours before an earthquake, Prof. Milne thinks that that must be attributed to accidental causes. In volcanic districts it sometimes happens that, before an earthquake, emanations of gas through fissures in the earth occur, and small animals are not only frightened, but are also killed by such premonitory phenomena.

Glands of Labiatæ and Compositæ.—Dr. Tschirch, of Berlin, in a paper on the receptacles of secretion in plants, and the origin of some secretions, pointed out that the epidermal glands on the leaves, flowers, and stalks are of two distinct types in the *Labiatæ* and *Compositæ*, so that they might serve as diagnostic of these two natural orders. In the *Labiatæ* the epidermal glands have in their interior a compact circle of secreting cells, which are always in a multiple of four, and are usually eight or sixteen in number. The upper cell of the gland is also divided by radial walls perpendicular to its surface. The glands of the *Compositæ*, on the other hand, have superimposed layers of secreting cells, though the term is often only strictly applicable to the two uppermost. The whole of the secreting cells are divided in two by a median radial wall, which is usually at right angles to the longitudinal axis of the organ. The number of secreting cells is consequently four, in two layers, or six, in three layers. Seen from above, the oil glands of the *Labiatæ* show a circle of usually eight cells around a central one, while those of the *Compositæ* exhibit a long oval cell divided in the middle of the gland.

A Plant Heilostat.—Prof. B. D. Halstead calls attention, in Coulter's *Botanical Gazette*, to the heliotropic power possessed by the leaves of *Malva borealis*, a common weed in Southern California. The leaves follow the sun during its daily course, and present their upper surfaces to the descending rays. The blades face eastward in the morning, and, as the day advances, the laminæ turn to the south and become more nearly horizontal. During the afternoon the blades approach the vertical, and at sunset they face the western sky. In short, the malva leaves are living heliostats.*

Birds Killed by Monuments.—Prof. Ridgway, of the Smithsonian Institution, speaking of the birds sent to the Institution killed in large numbers by flying against the Bartholdi statue beacon in New York harbor, says that the specimens were mainly of the "warbler" or note-uttering family of different varieties, which were insectivorous, and also field birds, such as the madow lark, but none of the specimens is rare. These birds migrate by night, and, although they fly high, Prof. Ridgway says that they are attracted from all sides down to the electric light. Many birds, mostly crows, have recently been picked up dead near the Washington monument. A few wild ducks also have been destroyed in the same manner. The crows fly low and migrate at dawn, and the mist hides the monument from sight.

Explosive Power of Nitro-Glycerine.

An instance of the extraordinary explosive power of a small quantity of nitro-glycerine is recorded by Dr. Gorup Besamez. The incident was the explosion of only ten drops of the substance in his laboratory, and the astonishing effects he records as resulting from this explosion are well calculated to give a most respectable and respectful notion of the properties of nitro-glycerine. One of the doctor's pupils, in the course of an investigation, placed the above mentioned quantity (?) of the substance in question in a small cast iron dish heater over a small Bunsen gas burner in common use in laboratories. While so engaged the nitro-glycerine exploded with extreme violence, breaking forty-six panes of glass in the windows of the laboratory, hurled the iron dish against the brick wall, the iron stand upon which it was supported partly split and partly twisted out of shape, and the tube of the Bunsen burner split and flattened. Those in the laboratory fortunately escaped without injury.

* Cf. SCIENTIFIC AMERICAN SUPPLEMENT, No. 615, p. 9880.

Interesting Brake Trials.

On November 21 last, a special train took about 300 gentlemen to Ridgefield Park, N. J., on the West Shore Railroad, where a number of tests were made by the Westinghouse Air Brake Company of the new application of its system of braking to long freight trains. The air brake has been used very successfully on freight trains of not more than 25 cars, but it was found that when this number was exceeded the bumping of the rear cars, which had not yet been stopped, against the cars in front was so serious as to set a limit to the system's utility as far as freight trains were concerned. While it took ten seconds for the application of the air brake to reach the front part of a train of 50 freight cars, it took 15 seconds for it to reach the rear part, and it was to demonstrate that he had practically annihilated this difference and made the air brake's advantages available on long freight trains that Mr. Westinghouse took the visitors out for a trip on the West Shore Road.

Just beyond Ridgefield Park the road has a straight stretch of double track about 2 miles in length, with a grade of 53 feet to the mile throughout the entire distance of the track. Upon this the various tests were made. Between the two tracks, a half mile north of the station, a white board was set up. This was the stopping point. South of it, at distances of 50 feet apart, were measuring posts, the last marking 600 feet from the stopping post. A freight train of 50 cars, 1,900 feet long, and weighing 2,000,000 pounds, drawn by a mighty engine of the Chicago, Burlington, and Quincy road, and the 12 car passenger train which had brought the party, completed the railroad apparatus involved in the experiments.

An emergency stop, with the freight train running 20 miles an hour, was the first test. The brake was applied at the instant the post was reached. Twelve and a quarter seconds later, at 200 feet from the post, the train was at a standstill. The next test was made with similar conditions, except that the train was run at a speed of 41 miles an hour. This time the train was stopped in 20 seconds, and at a distance of 674½ feet from the post.

The third test was of the rapidity with which the brakes were applied, the train standing still, so that observers could tell the time which elapsed between the engine whistle which announced the application of the power and the sound of the moving brake at various distances along the train. The cars numbered in order from front to rear of the train, and to persons who stood opposite car No. 31, the two sounds described were synchronous.

Another test with the passengers on board was made with the train running 41 miles an hour, when the stop was effected at a distance of 672½ feet, and in 20 seconds, as before. A fifth test showed that after the train had come to a stop the brakes could be released and the train set moving again in 4 seconds.

To show the difference between the air brake stop and the old hand brake style, a test of the latter, with six brakemen on the train, was made. The train moved at 21 miles an hour, but it had traveled for 85 seconds and covered a distance of 2,137 feet before it was brought to a standstill, after the signal had been given. Then the train was broken in two while in motion. After the separation it traveled a very short distance, and when both portions came to a stop in 26½ seconds, they were only 45 feet apart. These tests were made with the braking power so low that it would not slide the car wheels. A high pressure test, with the train running 22 miles an hour, resulted in its being pulled up in 6 seconds, 91 feet from the stopping post.

The last test was, spectacularly, the best of the afternoon. It was intended to show the relative stopping power of the old brakes, as used on the 12 coach passenger train, and the new brakes on a 20 car freight train. Down the tracks, chimney and chimney, came the two trains. Forty-five miles an hour was the speed at which the trains were going as they neared the stopping post, and the freight train was only about three feet in front as they passed it. The brakes on both were applied simultaneously, but the new brake distanced the old one, the freight train stopping in 13½ seconds, at a distance of 495 feet, while the passenger train went on traveling until its engine was 1,204 feet from the stopping post.—*New York Times.*

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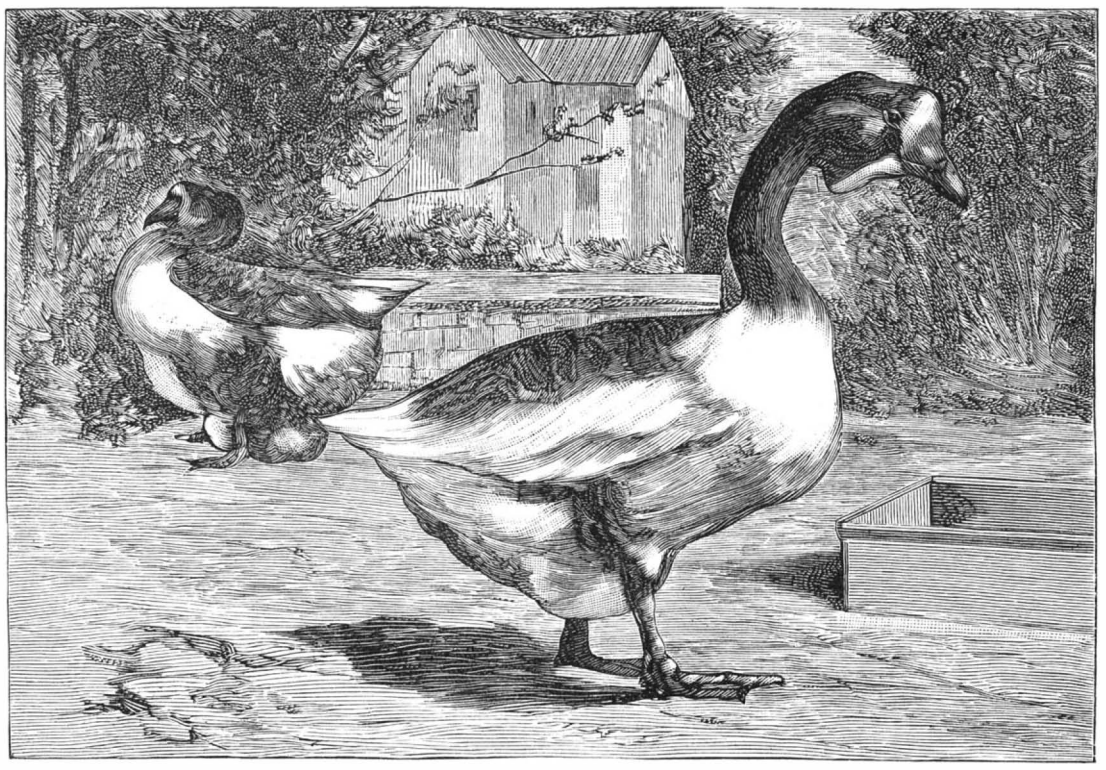
MADAGASCAR GEESE.

At the beginning of the present year, Mr. E. Lemoine, of Crosne, one of our most distinguished breeders, received a pair of geese from Madagascar, the first of the species that have been introduced into France. These birds figured with distinction at the last general agricultural exhibition at Paris, and are now getting along thrivingly in the beautiful park of their owner.

According to data gathered by Mr. Lemoine, these fowl are called "royal geese" in Madagascar. They are quite rare at Tananarive, where they are considered as fancy birds. They are worth no less than $12 per pair. The ones under consideration are seventeen months old. They were given by the instructor-general of the Malgash troops to a Mr. Gregory, who brought them to France. They started from Tananarive on the 15th of August, 1886, and were carried on a man's back to Tamatave (a journey of seven days), and remained there three months exposed to a torrid heat. On the 20th of November they were shipped on the steamer Erymanthe, which carried them to Reunion, where they were transferred to the Sydney. Here they suffered to such a degree from the narrowness of their cage that, on crossing the equator, Mr. Gregory thought he would be obliged to throw them overboard. From Port Said to Marseilles a violent tempest made its effects felt, while at the same time it became intensely cold. The geese were landed at Marseilles on the 17th of December. From what precedes, we may conclude that these birds have a very vigorous constitution, and that they are extremely hardy. Since they have been in Mr. Lemoine's possession it has been found that they will tolerate various sorts of grain—wheat, oats, buckwheat, corn, etc. It remains to learn the result of egg laying, as regards quantity and fecundation. The plumage of these birds is gray above and white and gray on the rest of the body. Their feet are very strong, and their body is somewhat squat. The shape of the bill has a great analogy with that of the Guinea goose.

The male weighs twenty-two pounds and the female nineteen. At the same age, the Toulouse male goose weighs, on an average, seventeen pounds and the female about the same. The female has laid eight eggs, one of which was broken by her. One of these weighed nine ounces and the six others eight ounces on an average. These eggs, unfortunately, proved infertile. Two of them were submitted to an incubation of thirty-two days, and the five others remained under a turkey hen for forty days. Does the infertility depend upon a change of climate, or upon the age of the birds? This is what the future is to teach us. Mr. Lemoine is in hopes of obtaining a brood next year. A crossing of these colossal birds with our common geese would improve the latter considerably.—*La Nature.*



MADAGASCAR GEESE.

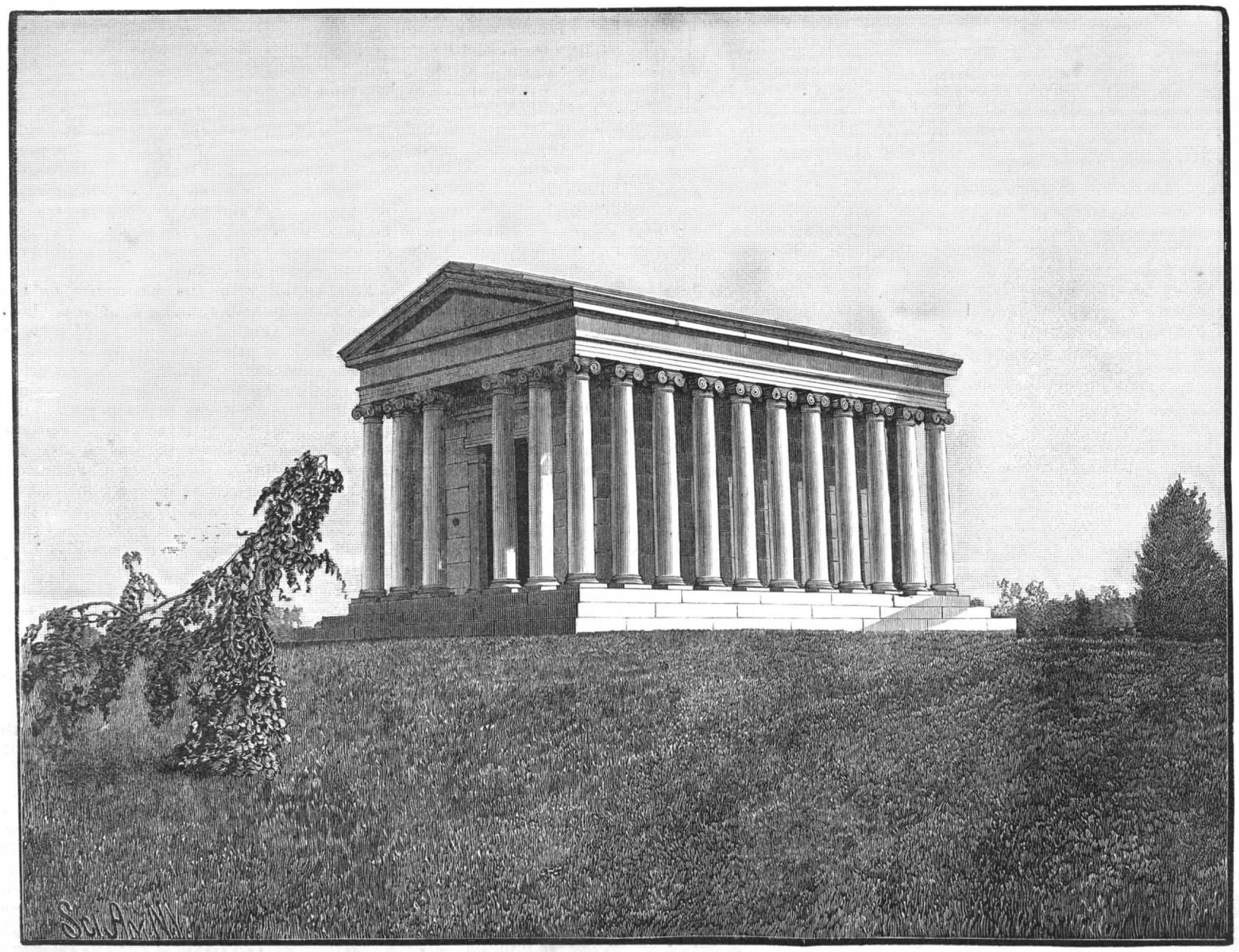
State Regulation of Commerce.

The Supreme Court of Vermont lately held unconstitutional a statute requiring a license of a person peddling tea, the growth of a foreign country. (State vs. Pratt.) The court cited with approval the decision of the Supreme Court of the United States in the case of Welton vs. Missouri, in which the latter court held that where the business or occupation for which a license is required consists in the sale of goods, the license tax is upon the goods themselves, and held unconstitutional a statute of Missouri requiring a license of peddlers selling goods not the growth, product, or manufacture of that State. The Vermont court said: The same rule, obviously, must apply to a statute which permits the free sale of goods of Vermont growth, but taxes the sale of those grown in foreign countries, inasmuch as the clause giving to Congress the power to regulate commerce specified interstate and foreign commerce in the same section.

JAY GOULD'S TOMB.

Probably no cemetery in this country can boast of a more classical specimen of mortuary architecture than is exhibited in the tomb of Mr. Jay Gould, in Woodlawn Cemetery, near this city. It is copied after the famous *Maison Carré*, at Nimes, France, built some two thousand years ago, and which is the best preserved and most beautiful specimen of Grecian architecture in existence.

Our artist, in the selection of the view he has chosen for showing the structure to good advantage, has exhibited good taste, but a wood engraving, even though as artistic as this is, fails to picture the full beauty of this handsome marble structure, with its graceful Ionic columns, reared upon a grass-covered knoll, where it commands a striking view of the surrounding country.



JAY GOULD'S TOMB IN WOODLAWN.

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ENGINEERING INVENTIONS.

A shoe attachment for car trucks has been patented by Mr. Elwood H. Newman, of Asbury Park, N. J. The invention consists in the application of longitudinally flanged shoes of novel form and in a novel way to a car truck, whereby a car upon jumping a track will be held in more or less engagement therewith, and prevented from falling from a bridge or down an embankment, and the engineer will be notified.

A hydraulic engine has been patented by Mr. Charles R. Whittier, of Yonkers, N. Y. The invention consists principally in providing such engines, used for operating elevators, with automatic valves or cut-offs between the main operating valve and the cylinder, or within the cylinder, for stopping the piston at both terminals without danger of its coming in contact with the cylinder head and without impeding its movement in the opposite direction.

MISCELLANEOUS INVENTIONS.

A gate latch has been patented by Mr. George W. Charleville, of Baird, Texas. The invention covers a novel construction and combination of parts for a latch which avoids the use of springs, and possesses no complications of parts likely to get out of order, while it can be cheaply made.

A washing machine has been patented by Mr. Ira B. Stillman, of Wellsville, N. Y. This invention covers an improvement on a former patented invention of the same inventor, and provides a reversible roller depressing spring, to avoid the danger of the bars becoming set at any particular curve.

A baling press has been patented by Mr. William C. Ellis, of Rising Sun, Ind. It may be mounted on a wheeled truck, and the invention covers a novel construction, making a press designed to be inexpensive, durable, and efficient for a wide range of work, in pressing hay, straw, cotton, and similar material.

A folding seat or chair has been patented by Mr. Amos H. Underwood, of Auburn, N. Y. It is especially applicable to sewing machine or type writing machine tables, permanently connecting therewith a light and strong seat or chair, easily adjusted for use and capable of being folded beneath the table when not in use.

A jar clamp has been patented by Mr. Henry H. Davidson, of Northport, N. Y. It is for hermetically securing covers upon fruit jars or like packages, and consists of a wire or bar adapted to grasp or fit upon the open end of a jar, and having a transverse bend, a cam lever being fitted on the bend of the wire or bar.

A double seaming machine has been patented by Mr. Virgil Crockett, of Dexter, Me. It is for making a double seam in tinware, the machine providing means for easily and quickly setting the different sized disks, while the heads may be quickly changed, and no spring or other delicate mechanism liable to frequent disarrangement or breakage is employed.

Sheathing paper forms the subject of a patent issued to Mr. William H. H. Childs, of Brooklyn, N. Y. The invention covers a compound paper consisting of two or more layers cemented together in the center by one composition and at the edges by another, making a waterproof disinfecting or anti-moth paper of improved quality.

A projectile for rifled guns has been patented by Mr. John G. Butler, of Springfield, Mass. It is made up of metal of two or more qualities, as hard and soft steel, or hard steel and wrought iron, these metals being in alternate disks or rings, and welded one to the other, the head of the projectile being adapted to take a high degree of hardness.

A pipe thread protector has been patented by Messrs. William H. and Harry W. Pickett, of Warren, Pa. It is made in the form of a ring, preferably of sheet metal, with an inturned flange at its outer end which laps upon the end of a pipe, for protecting exterior threads on the ends of pipes from injury during handling or transportation.

A baling press has been patented by Mr. Moses C. Nixon, of Peru, Ind. It is of that class known as "continuous" presses, the invention providing novel constructions of condensing, feeding, and pressing devices, with improved operating mechanism, and various novel details in the combination and arrangement of parts.

A cotton press clamp has been patented by Mr. William F. Moss, of Fitzpatrick's, Ala. Combined with the side doors are hooked sections having hooked ends or points extending in inverse directions, permitting the same to interlock, which may be quickly and easily manipulated to lock the doors of the press together, and will not be liable to accidental displacement.

A folding bed has been patented by Mr. Karmell Brooks, of New York City. A spring is so connected with brackets attached upon either side of the divisions in the side boards that when the lower section has been folded over and locked on the upper section, and it is desired to open the bed, the spring will act and take the burden of weight as the lower section is lifted.

A link driving belt has been patented by Mr. John K. Tullis, of Glasgow, Scotland. The invention consists in forming the leather links of a gradually increasing depth from the center toward the edges, thus constituting the driving surface of the belt into a rounded hollow channel, so that the belts will lie in more close contact with the rounded surface of the driving pulleys.

A horse detacher has been patented by Mr. John M. Fiedler, of Wentzville, Mo. It is an attachment for the singletrees of vehicles for holding and adjusting the traces, and detaching the horse in case of accident, and consists in a clamping buckle pivoted to the end of a singletree and adapted to engage the trace, a cord extending therefrom into the vehicle for releasing the clamping buckle.

A safety attachment for anchors has been patented by Mr. Nelson Smith, of Smithville South, N. Y. The invention consists in pivoting a triangular frame to the shank of an anchor between the flukes, so constructed that it will guide the cable clear of the non-embedded fluke without regard to the position of the ship, and in no manner interfering with catting the anchor.

A grocer's cabinet has been patented by Mr. John P. Flick, of Ottawa, Ill. Combined with top, bottom, and ends forming a casing are partitions extending entirely across the cabinet, open upon opposite sides, with rack bars, and other novel features, being especially adapted for holding wrapping paper, paper bags and boxes, butter dishes and twine, besides tools and various other articles.

A ball turning lathe has been patented by Mr. Tronson Draper, of Petrolia, Ontario, Canada. The invention consists of a face plate covered with leather and backed by an elastic material, means for stretching the leather cover, and means for holding the ball to be turned in contact with the leather-covered plate, in connection with various novel features of construction and arrangement of parts.

A book attachment has been patented by Mr. Aron Bieber, of Bieber, Cal. The invention consists of a spring-acted plate bent to receive the edge of the book cover, and provided with a slide in which is inserted an elastic band which passes around the cover and around the leaves of the book, to mark the place temporarily and bind the leaves of the book together against the cover.

A tobacco pipe has been patented by Mr. August Werner, of Leadville, Col. A block is hinged to the base, with a bowl open at both ends pivoted at about the center to the block, whereby the bowl may be reversed and fire held within it, the base being provided with a receptacle for any proper absorbent and provision being made for the cleaning of the stem and base.

A music leaf turner has been patented by Messrs. John T. Carrington and Andrew J. Sleeper, of Clay Center, Kan. It is designed to enable the performer to turn the leaves by touching finger plates on levers near the keyboard, or by the use of a foot pedal, the invention covering novel features of construction and the combination of parts to make a simple and inexpensive device.

A trace fastener has been patented by Mr. Samuel M. Stevenson, of Bastrop, La. Combined with a singletree mortised vertically through each end is a retaining bolt having a hook upon one end and a fork upon the other for engaging the ring of the trace, the arrangement being such that the draught is upon the singletree, and the fastener is subjected to very little wear or strain.

A tricycle has been patented by Mr. Hermanns T. Frie, of Curaçoa, West Indies. The invention consists of a rocking chair located on the frame and operating at its free end on a segmental gear wheel, connected by a train of gear wheels with the axle of a driving wheel, being designed to make a machine which can easily be propelled very fast without much exertion on the part of the operator.

A bed slat fastener has been patented by Mr. Lafayette B. Hopkins, of Council Grove, Kansas. The side rail is provided at its inner face with an auxiliary rail, supporting a rail iron which supports the bed slat, the latter being provided with a slat iron which interlocks with the rail iron, to hold the slat securely while allowing instant removal when required, and also prevent lateral spreading of the rails of the bedstead.

A resistance regulator for electric currents has been patented by Mr. Georg Montanus, of Frankfort-on-the-Main, Germany. The invention consists of a number of wires forming a rheostat and connecting a number of springs with the terminals of the motor, and of a ring having a segmental flange which, when turned, connects the first flange of the number of wires with any desired number of the remaining wires, being especially adapted for electrical dental motors.

A hoisting machine has been patented by Mr. Walter Hart, of East Orange, N. J. Two disks are arranged to rotate in different planes, one of them beveled or coned, the other plain or beveled, the angles of the disks being arranged so that one point in the surface of each will be parallel with the corresponding part of the other disk, on opposite sides the disks gradually receding, with other novel features, making a device for hoisting and lowering heavy bodies.

A hoisting and conveying machine has been patented by Mr. William Thornburgh, of Elyria, Ohio. Combined with a main shaft is a frame adapted to swing longitudinally and operated from the shaft, a swinging pulley hanger being held on the outer end of the swinging frame, with other novel features, the machine being adapted for hoisting, loading, or unloading iron or coal or other articles from or to the holds of vessels, cars, or other places.

A filter has been patented by Messrs. Jacob Waespi, Emil Fretz, John Spellman, and John Frey, of Dallas, Texas. The receptacle has receiving, settling, and filtering chambers, there being transverse wedge-shaped ridges in the bottom of the latter, outlet pipes being arranged at the bottoms of all the chambers, the several chambers being easily cleaned, and the arrangement being such that one can be cleaned while the other is working.

A coupling for gas, steam, or water pipes, etc., has been patented by Messrs. Harrison Traver, of Brooklyn, N. Y., and John Weeks, of New York City. The invention covers a novel construction and combination of parts for a coupling which is designed to be unaffected by expansion or contraction, and wherein the supply will be automatically cut off from one section of pipe while the other section is disconnected therefrom.

A speed indicator for vessels forms the subject of two patents issued to Mr. Charles Sperry, of New York City. It has a pressure chamber with a flexible diaphragm, and connected upon both sides of the diaphragm to an outside double tube, in combination with registering mechanism and mercury chambers, indicating varying pressures according to the speed with which the vessel is moved through the water, and in combination therewith is a clockwork and registering system, showing the distance that the vessel to which the instrument is attached has covered since the time of starting.

A shutter for photographic cameras has been patented by Mr. William H. Lewis, of Brooklyn, N. Y. Combined with an apertured sliding shutter is a lever adapted to throw it, a spring, and an adjustable slide, with means for clamping or holding it when adjusted to vary the tension of the spring, the invention being more especially applicable to shutters having a straight sliding movement, adapted to both instantaneous and time work.

A camera especially adapted for instantaneous work has likewise been patented by the same inventor. It has a focusing device by which the camera tube may be focused approximately without observing the image on the ground glass of the camera, an improved spring device for holding the ground glass and for receiving and holding the plate holder, an improved finder, means whereby the speed of the closing of the shutter may be regulated, and buffers of peculiar form for arresting the motion of the shutter after being released, with other novel features.

A grindstone frame has been patented by Mr. William Thornburgh, of Elyria, Ohio. Combined with the side bars and legs is a clamp having openings in its bottom and sides, into which fit the ends of the side bars and legs, a vertically moving wedge fitting on the inside edges of the legs, and a bolt and nut for holding the wedge in place, with other novel features, making a frame which can be readily knocked down for transportation and easily set up and fastened together.

A scissors sharpener has been patented by Mr. Isaac A. Abbot, of Denver, Col. It consists of a stock having a sharpening disk held thereto and a gauge with a flange against which the blade to be sharpened rests, the gauge being held to a curved end part of the stock by screws, allowing adjustment of the flange at various angles to the periphery of the disk, the blade to be sharpened to be drawn across the disk with its inner face flat against the gauge, the wire edge made by the disk being at the same time removed by another edge.

SCIENTIFIC AMERICAN BUILDING EDITION.

NOVEMBER NUMBER.

TABLE OF CONTENTS.

1. Elegant Plate in Colors of Three Frame City Dwellings, costing Two Thousand Five Hundred Dollars each, with floor plans, sheet of details, etc.
2. Plate in Colors of a Frame Dwelling, situated at Belleville, N. J., costing Two Thousand Five Hundred Dollars, with full specifications, floor plans, sheet of details, etc.
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4. Plans for a School House costing between Eight and Nine Thousand Dollars.
5. Half page Engraving of a Residence at Battenhall Park, Worcester, England.
6. Perspective view, with floor plans, of a Dwelling costing Four Thousand Five Hundred Dollars.
7. Drawing of a Reception Pavilion, Geneva.
8. Illustration of the New Railroad Men's House, New York. A Club House costing One Hundred Thousand Dollars.
9. Design of an Attractive Residence at Minneapolis, Minn.
10. A Church of moderate cost, with first story plan. Intended for 450 seats.
11. Engraving of a Two Story and Attic House erected at Montclair, N. J., with floor plans. Cost, Thirty-seven Hundred Dollars.
12. A Thirty-five Hundred Dollar Dwelling. Perspective and floor plans.
13. Page Engraving of the New Monument and Tomb of M. Thiers, Cemetery of Pere la Chaise, Paris.
14. Design for an Entrance. Half page engraving.
15. Perspective and floor plans of a House costing Three Thousand Eight Hundred Dollars.
16. Design for a City Front. W. H. Powell, Architect, London.
17. Floor plans and perspective of a House for a narrow lot. Cost, Four Thousand Dollars.
18. Perspective and floor plans of a Four Thousand Five Hundred Dollar Residence.
19. Miscellaneous Contents: Putting Water Heating Pipes in Cook Stoves, illustrated.—Cedar Shingles.—The Trade Unions.—Some Data on Steam Heating.—Plastering.—The Rumbling Sound in Closed Carriages, how prevented.—Pipes and Joints.—Jack Frost in Water Pipes.—The Effect of Freezing on Cement.—The Wood of Thuja Gigantea.—A Dutch Interior.—Spontaneous Combustion.—Cement Apparatus.—How to Repair Stone Steps.—Insulated Air Coverings for Steam, Water, and Gas Pipes, illustrated.—The New Era Radiator, illustrated.—Shingle Stains.—Effects of Snow on Marble.—"Alert" Hand Force Pump, illustrated.

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It is a folly for any physician to declare that he covets hopeless cases, or patients who have been "given up" by other practitioners. Sensible men, with pride in their art and reputations that they prize, do not seek to imperil their noble profession or their own fame. Insurance companies avoid taking risks on threatened lives. Of course every practitioner whose heart is not stone does take cases that imperil his success. He does so because he loves his fellow man. At the same time disease is most effectively grappled with in its earlier stages. Neglect of apparently trifling disorders leads to the many complicated cases which baffle the highest skill, when any one of the maladies existing alone could be handled by the physician with certainty. When the system has become the slave of some overmastering physical complications, a complete regeneration alone suffices to restore health. The blood, the nerves, and the digestive and urinary machinery must be thoroughly overhauled. For this nothing has ever been found that equals the Compound Oxygen Treatment. The New York *Tribune* recently declared that the successful application of oxygen gas to medicine has stimulated the most urgent search for new methods of making it unattended with the long and expensive process that has so long been used. Drs. Starkey & Palen, No. 1529 Arch Street, Philadelphia, Pa., have met with unprecedented success in apparently hopeless cases of lung and heart diseases in the administration of their Compound Oxygen, and this encourages them to urge its merits. They have many imitators, some of whom, even with imperfect appliances, effect a few cures. But the best is not only the cheapest, but the safest. Drs. Starkey & Palen have a large office practice that employs themselves and several assistants during the day. They have introduced a system of Home Treatment, by which they send the Compound Oxygen to all parts of the country for a very low price. It should not be understood that they prefer to treat patients at long range. On the contray, their large and magnificently appointed offices, 1529 Arch Street, are crowded daily. One visit, at least, is always desirable, but where that cannot be had the next best thing must be done. The sufferer should write a full description of his or her condition to Drs. Starkey & Palen. They will give an honest opinion of the case, and their advice will cost nothing.

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The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

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The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

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As a perusal of this work will show, this is a woman's way of looking at the great national hero; and although the ground traversed has been trodden before, it possesses interest from its actual familiarity, and tells a story of which one never tires. The work contains a series of pictures which take hold of the fancy and give a pretty vivid picture of the great man and his surroundings. The type is bright and clear and the illustrations well selected, rendering the work an appropriate one to be put in the hands of the young, for whom it was principally written.

EASY LESSONS IN THE DIFFERENTIAL CALCULUS. By Richard A. Proctor. London: Longmans & Green. 1887. Pp. vi, 114.

This little work is reprinted from the columns of *Knowledge*, the well known scientific journal, which is edited by Mr. Proctor, who also contributes a great part of the matter that appears in its columns. The book purports to give a thoroughly practical view of the subject. The work, small as it is, contains, according to the author's statement in the preface, rather more of the differential calculus than he was obliged to take up in studying for a degree at Oxford University. The general idea is to give the more practically useful applications of the science, such as determination of maxima and minima, quadrature of areas, and the like. The work is of pocket size, and in giving a more popular cast to the subject should be serviceable in removing some of the dread which people are apt to entertain for calculus.

FIRST STEPS IN GEOMETRY. By Richard A. Proctor. London and New York: Longmans, Green & Co. 1887. Pp. viii, 179.

This work attacks the solution of geometrical problems, such as questions in maxima and minima, rather than the study of propositions. It is not very extensive, as is evident from the limited number of its pages, but it, like the calculus of the same author, forms a pleasing pocket manual and complement to the ordinary course in geometry. For those who find their mathetics growing rusty, this work may be recommended as adapted to refresh the mathematical knowledge so often laboriously acquired and quickly forgotten.

A SHORT HISTORY OF ARCHITECTURE By Arthur Lyman Tuckerman. With illustrations by the author. Charles Scribner's Sons.

As its title indicates, this is an elementary work giving in a clear, incisive, interesting way, a brief account of the origin and growth of the various styles of architecture. As it passes over the entire province of architecture, it gives the reader little more than a glance at the various topics touched upon, but the glance is comprehensive and instructive, and although we do not, of course, look for anything absolutely new, we have facts put before us in such a way as to leave an impression that will render these facts available for reference and future use. The author has endeavored to bring out the distinctive features of the various types and to emphasize their more prominent characteristics. Pages 168, price $1.50.

A MANUAL OF ANALYTICAL CHEMISTRY, QUALITATIVE AND QUANTITATIVE, INORGANIC AND ORGANIC. By John Muter, M.A., Ph.D., etc. Philadelphia: P. Blakiston, Son & Co. 1887.

This work is calculated for the English Technical School requirements. It is largely in the form of schemes of analysis, not being a treatise on the subject in the sense of Fresenius' or Rose's works. It is a very useful laboratory companion, though for purposes of instruction, where the student is to be made a chemist and not a mere analyst, it should be supplemented by a more extensive work. In books of this class the danger is that a student may acquire the idea that every precipitate is absolutely insoluble, and that every analysis must go by the scheme like clockwork. Chemistry in its full scope is better studied by the defects of analytical processes than by their too successful application to simple analyses.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) F. H.—Marble is finished by grinding the surface with fine sand under a slab of stone, which may be a piece of marble or sandstone, to a true surface. Then the surface is smothed with ground pumice stone under a rubber of leather or felt, and afterward polished with oxide of tin and water with a rubber of felt. The rubber is fastened to a block of wood.

(2) F. S. A.—No satellites or planets move in circles, to our knowledge. There is a possibility of comets moving in parabolas or hyperbolas; but the probability is that all orbits to which our sun is a common center are elliptic. The influence of the planets upon comets may often be such as to change their orbits apparently to hyperbolas, as also to change the direction of the axis of their future orbits. We have yet to find that any cometic orbits are *interstellar*.

(3) J. B. C.—Lead does not run smooth in casting with any kind of mould, nor do we know of any elastic substance that will not be destroyed by the heat of melted lead. If you can alloy the lead with tin or with tin and bismuth, it will run smooth at much lower temperature than the melting point of lead. Old type make a smooth-running metal, which can be cast in plaster of Paris moulds.

(4) W. C. D. asks how solar prints are made. A. Specially prepared silvered paper is placed in a large extension camera, upon which the enlarged image is received. After an exposure of 15 minutes to sunlight, the paper is removed in a holder and to a dark room, where the picture is developed by means of special preparations. This slow method is now largely superseded by the employment of bromide paper, which is much more rapid and can be used with artificial light. In a dark room the paper may be pinned to a wall, and the enlarged image of a negative in an apparatus like a magic lantern be thrown upon it for about two or three minutes. It is then removed and developed in a solution of iron and oxalate of potash called ferrous oxalate, fixed in hyposulphite soda solution, washed, and dried. In all cases it is essential that a glass negative, somewhat thin, be secured from the paper photograph. Better still, use the original negative when possible.

(5) W. O. says: Will you kindly oblige one who, although a helpless invalid for fifteen years, is still much interested in your paper, by giving him the best information at your disposal? 1. What is the composition and process of manufacture of the best artificial stone sidewalk you know of? A. To make a cement walk, level the ground and pack the earth well; then spread upon it a stiff mortar three inches thick, of sharp sand four parts, best cement one part. Cover this while fresh with another coating of mortar made of best Portland cement one part, clean, sharp sand 2 parts. 2. Is there a reliable artificial building stone? If so, what is it composed of? A. Good artificial stone is made of best Portland cement one part, clean, sharp sand two parts, mixed stiff, shaped in boxes to give the desired form of blocks.

(6) J. J. C. asks the best coating or covering to prevent water pipes from freezing. A. Heavy hair felt and mineral wool covering, boxed, or boxing and filling with sawdust, hay, or straw, are all suitable for preventing freezing. The size of the box should be made suitable to the intensity of exposure; ½ inch or ¾ inch water pipe should have from 3 to 5 inches of space all around filled with packing where exposed to cold winds.

(7) J. T. D. writes: When lead is plated with copper and used to make a steam joint, will the copper protect the lead from the steam? A. Lead does not make a good steam joint under any condition; it is too plastic. The copper cover will protect the lead from the action of the steam, and in this combination may make a joint that will answer for some purposes, but not as good as a corrugated pure copper gasket.

(8) T. N. C. asks why the Christian era commences four years after the birth of Christ. A. Our present era was fixed by Dionysius Exiguus in 525 A.D., and the latest edition of the Encyclopædia Britannica is authority for the statement that "we cannot demonstrate the exact year of the nativity, but critics of all schools are verging more and more to the acceptance of 4 B.C. as the probable year of Christ's birth."

(9) W. N. asks how to dress the skins of birds so that they can be pieced together and made into a small robe or mat. A. Thoroughly impregnate the fibrous part with a mixture composed of 4 parts alum and 1 part alum and saltpeter. Arsenic powder is also sometimes used in similar work as a protection from insects and vermin, but the danger of employing such a poison is evident. For directions about skinning and stuffing birds, see Spons' Workshop Receipts, first series, which we mail for $2.00.

(10) E. H.—The first French steam railway was the Paris and St. Germain line, 11 miles long, opened in 1837.

TO INVENTORS.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

November 15, 1887,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Air compressors, valve gear for, E. M. Strange.... 373,419
Alarm, W. G. Joerke.... 373,073
Alarm lock, R. G. Vassar.... 373,111
Alloy, C. C. Carroll.... 373,221
Bag holder, A. Schedin.... 373,199
Bailer, D. F. Brown.... 373,266
Baking tin, I. E. Brown.... 373,124
Baling press, M. S. Coleman.... 373,341
Baling press, J. La Dow.... 373,076
Battery. See Galvanic battery. Therapeutic battery.
Battery jar, C. A. Brown.... 373,334
Bed cover holder, M. C. Murray.... 373,424
Bed, sofa, C. E. Barber.... 373,329
Bedstead, folding, G. W. Bent.... 373,121
Bell, automatic signal, A. P. Whiting.... 373,115
Bell, electric, G. M. Sternberg.... 373,102
Bell, signal, H. E. Russell, Jr.... 373,416
Belt, electric, G. S. Bennett.... 373,044
Blind stop, W. W. Rexford.... 373,308
Blind, window, J. B. Hartman.... 373,067
Board. See Wash board.
Boat detaching mechanism, J. W. Willing.... 373,325
Boiler. See Culinary boiler.
Boiler flue attachment, J. Kelly.... 373,237
Bolt. See Double-acting bolt.
Boot, felt, W. F. Quigley.... 373,305
Bottle stopper, Tucker & Roorbach (r).... 10,881
Bottle washing machine, N. J. Simonds.... 373,315
Box. See Journal box. Tobacco box.
Bran duster, J. B. Allfree.... 373,327
Brick machine, W. T. Duvall.... 373,134
Bridge gate, swinging, C. K. Cordrey.... 373,130
Bridle check piece, C. Russwurm.... 373,097
Brush, fountain scrubbing, W. N. Rowe.... 373,197
Buckle, harness, J. H. Neill.... 373,245
Buckle, suspender, M. Hyman.... 373,405
Buckle, trace, J. J. Wallace.... 373,209
Bung making machine, E. E. Elder.... 373,345
Burner. See Lamp burner.
Bustle, H. O. Canfield.... 373,050
Bustle, M. B. Hammond.... 373,286
Button, S. B. Simon.... 373,250
Buttonhole piece, J. Reece.... 373,153
Button or stud, G. E. Adams.... 373,041
Button, spring cuff, E. K. Haynes.... 373,401
Button tuft or ornament, H. A. Cables.... 373,128
Buttons, etc., toggle fastening for, C. V. Richards 373,309
Cable grip, L. D. Libbey.... 373,188
Calendar, perpetual, A. H. Isbell.... 373,235
Can cover clamp, H. Cottrell.... 373,274
Can opener, W. B. Nutter.... 373,412
Cane, walking, O. H. Byring.... 373,049
Canning machine, D. D. Ranney.... 373,306
Canvas stretcher, D. G. Smyth.... 373,156
Car coupling, R. R. Asbury.... 373,042
Car coupling, P. Campbell.... 373,336
Car coupling, J. Timms.... 373,422
Car coupling, T. Welch.... 373,210
Car heater, G. F. Higgins.... 373,185
Car heating apparatus, J. H. Sewall.... 373,314
Car mover, L. B. Gifford.... 373,358
Car, railway, H. H. Sessions.... 373,098
Car signal, Farmer & Shaw.... 373,065
Car starter, H. P. Titus.... 373,208
Car wheel, J. A. Woodbury.... 373,213
Car wheel rims, die for shaping, G. W. Miller.... 373,084
Card list, J. H. Fezandie.... 373,279
Carding machine, condensing, M. E. George.... 373,137
Carriage top irons, machine for drilling, F. Schreidt.... 373,204
Carriage top irons, machine for filing, F. Schreidt.... 373,203
Carriage top irons, machine for sawing, F. Schreidt.... 373,202
Carriages, gear iron for, J. F. Fallon.... 373,227
Carrier. See Cash and parcel carrier.
Cash and parcel carrier, J. Burns.... 373,172
Casting ingots, smoking moulds in, J. Illingworth. 373,186
Chair. See Convertible chair.
Check register, J. H. Guest.... 373,397
Churn, H. J. Wagner.... 373,113
Cigarette machine, J. Floyd.... 373,351
Clamp. See Can cover clamp.
Clock, H. A. Russell.... 373,249
Clock synchronizing apparatus, C. J. Hexamer.... 373,138
Closet. See Water or other closet.
Cloth finishing machine, E. Rau.... 373,193
Coke in ovens, device for watering, T. S. & J. E. Stewart.... 373,417
Combing fibrous substances, machinery for, P. Heilmann-Ducommun.... 373,365
Compressor cross head, A. Snyder.... 373,381
Convertible chair, G. M. & F. P. Mann.... 373,296
Conveyer, J. Creager.... 373,389
Cooler. See Milk cooler.
Cord or twine, machine for making, G. L. Brownell.... 373,385
Cot, folding, H. D. Hard *et al*.... 373,363
Cotton compressor, J. A. Gaboury.... 373,357
Cotton, etc., machine for opening and cleaning, R. Kitson.... 373,075
Coupling. See Car coupling. Pipe coupling. Thill coupling.
Coupling, Traver & Weeks.... 373,256
Coupling for hose, steam pipe, etc., Jacobson & Bade.... 373,292
Cuff fastener, H. A. Clark.... 373,272
Culinary boiler, C. D. Salfield.... 373,310
Cultivator, J. H. D'Lamatter.... 373,343
Cultivator, duster, and digger, W. C. Davidson.... 373,275
Cup. See Oil cup.
Cutter. See Washer cutter.
Decorticating machine, J. B. Vogel.... 373,161
Dental engine, W. A. Knowles.... 373,141
Dental engine, W. B. Mann.... 373,079
Double-acting bolt, H. Clemons.... 373,388
Door hanger, H. Fleming.... 373,178
Door lock, E. Yeiser.... 373,214
Door spring, W. Gilfillan.... 373,360
Drain pipe, T. W. Larrabee.... 373,077
Dress form, J. D. Richardson.... 373,414
Dress shield and making the same, G. A. Close.... 373,273
Drill. See Rail drill.
Dust collector, O. M. Morse.... 373,374
Earthenware, manufacturing, M. S. Higbie.... 373,290
Electric cable, A. E. Dolbear.... 373,394
Electric machine and electro-motor, dynamo, W. Main.... 373,145
Electric machines, automatic regulator for dynamo, C. D. Jenney.... 373,369
Electro motor, E. Thomson.... 373,108
Electric wires in underground conduits, sectional draw rod for placing, W. H. Hart.... 373,289
Electro motor and dynamo electric machine, W. Main.... 373,146
Electrode for forming clots in varicose veins, J. R. Hamilton.... 373,399
Elevator, V. Gelineau.... 373,285
Elevator, H. F. Wallmann.... 373,114
Engine. See Dental engine. Hydraulic engine. Steam engine. Vibrating engine.
Extension table, G. Hebebrand.... 373,068
Extension table, T. Skinner.... 373,316
Eyeglasses, C. H. Farley.... 373,349, 373,350
Farm gate, O. A. Williams.... 373,116
Feed water apparatus, J. F. Belleville.... 373,216
Feed water purifier, S. H. Mosher.... 373,191
Feed water regulator, G. S. Herrick.... 373,402, 373,403
Fence, Jay & Coate.... 373,368
Fence lock and stretcher, wire, C. F. Darnell.... 373,392
Fence rail, A. M. Brock.... 373,123
Fence wire spooling device, Martin McHenry.... 373,080
Fifth wheel blocks, making, W. H. & E. L. Baker. 373,263
File, paper, W. H. H. Claugue.... 373,388
Filter, J. Waespi *et al*.... 373,257
Filter for cisterns, M. Rice.... 373,377
Firearm, magazine, C. J. Ehbets.... 373,277
Firearm, magazine, W. Mason.... 373,298
Fire kindler, Clough & Flynn.... 373,340
Fish trap, J. Brosch.... 373,333
Flour mill, roller, N. Cornelius.... 373,342
Frame. See Grindstone frame. Sewing machine quilting frame. Sign frame.
Furniture base or support, M. Samuels.... 373,311
Gaiter, J. H. Elliott.... 373,062
Galvanic battery, C. Gassner, Jr.... 373,064
Game, ball, A. M. Freeman.... 373,136
Gas main, J. N. Pew.... 373,093
Gas, process of and apparatus for manufacturing, A. M. Sutherland.... 373,158
Gas supply, pressure gauge attachment for automatically controlling, W. B. Mann.... 373,078
Gate. See Bridge gate. Farm gate.
Glass by means of compressed air, apparatus for blowing, R. E. Donovan *et al*.... 373,132
Glass globes, manufacturing, R. G. A. Witt.... 373,117
Glove or mitten, R. D. Burr.... 373,048
Grain binders, cord tyer for, W. Butterfield.... 373,220
Grain cleaning and separating mill, M. Grollimund.... 373,066
Grain drying apparatus, P. Jepson.... 373,140
Grapple adjuster, E. A. Reed.... 373,194
Grinding and polishing material, C. M. Lindsey.... 373,289
Grinding or pulverizing mill, A. Morlock.... 373,190
Grindstone frame, W. Thornburgh.... 373,255
Guard. See Railway cattle guard.
Gun or firearm, repeating, J. W. Mullins.... 373,410
Handle, J. E. Gaitley.... 373,181
Hanger. See Door hanger. Shaft hanger. Shafting hanger.
Harrow and seeder, combined, C. Svendsen.... 373,159
Harrow, disk, M. G. Elliott.... 373,278
Harvester, self-raking attachment for, M. Dew.... 373,055
Harvesters, twine holder alarm for, J. Davaine.... 373,225
Hat bodies, machine for manufacturing, T. Shirley.... 373,205
Head rest, M. J. Koenig.... 373,142
Heater. See Car heater.
Heater, D. F. McHenry.... 373,082
Heel nailing machine, J. F. McMullett.... 373,409
Hides, machine for unhairing, J. W. Vaughn.... 373,112
Hinge, P. Forg.... 373,352
Hoisting and conveying machine, W. Thornburgh.... 373,255
Hoistways, door for, W. K. Crofford.... 373,053
Holder. See Bag holder. Bed cover holder. Paper holder. Photographer's plate holder. Surgical instrument holder. Shade holder.
Hoof expander, C. H. Shepard.... 373,380
Hook, C. Robin.... 373,096
Hopple, J. A. W. Burris.... 373,173
Horseshoe attachment device, J. Ott.... 373,091
Horseshoe machine, J. A. Burden.... 373,125
Hydraulic engine, C. R. Whittier.... 373,259
Indicator. See Mail box indicator. Weather warning indicator.
Injector for furnaces, air, W. S. Hutchinson.... 373,139
Insecticide, A. Fullwiler.... 373,396
Ironing tablet, C. Zimmerling.... 373,168
Jack. See Wagon jack.
Jar. See Battery jar.
Jar cover fastening, F. H. Palmer.... 373,248
Joint. See Railway rail joint.
Journal box, self-oiling, M. Garland.... 373,283
Key. See Telegraph key.
Lacing hooks, machine for setting, J. H. Reed.... 373,307
Lamp, B. J. M. Menge.... 373,083
Lamp burner, H. Gillette.... 373,065
Lamp burner, E. B. Requa.... 373,195
Lamp, gas, R. M. Dixon.... 373,057
Lamp, hanging, E. Fisher.... 373,280
Lamp, miner's, J. L. Morris.... 373,244
Lamp shade, G. E. Brehmer.... 373,219
Lamp, signal, R. J. Armour.... 373,169
Lamp standard, W. Patzer.... 373,303, 373,304
Lamp, standard, W. A. Penfield.... 373,376
Lantern, tubular, F. Dietz.... 373,056
Latch, gate, G. W. Charleville.... 373,271
Leather, machine for splitting scraps of, C. E. Roberts.... 373,196
Light. See Signal light.
Lightning rods, interlocking coupling for, G. R. Kress.... 373,407
Lithographic process, etc., L. Bertling.... 373,331
Lock. See Alarm lock. Door lock. Fence lock. Trunk lock.
Lock, W. H. Taylor.... 373,107, 373,253
Loom for weaving looped or terry fabrics, J. A. Campbell.... 373,175
Loom, hand, C. N. Newcomb.... 373,246
Looms, harness board for Jacquard, W. G. Northup.... 373,151
Looms, positive shuttle motion for, F. K. Wright.... 373,423
Magnetic separator, J. Wenstrom.... 373,211
Mail bag fastener, G. L. Walton.... 373,321
Mail box indicator, J. P. Tirrell.... 373,207

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Mechanical movement, J. H. Smallwood 373,317
Meter. See Rotary meter.
Milk cooler, A. McLeod 373,242
Mill. See Flour mill. Grain cleaning and separating mill. Grinding or pulverizing mill. Roller mill. Saw mill.
Mine shafts, device for operating the doors of, P. Steves 373,105
Mining machine, coal, S. McAllister 373,081
Mitten, C. Freschl 373,281
Moulder's riddle, C. Truesdale 373,382
Motor. See Electric motor.
Music chart, C. E. Hill 373,069
Music leaf turner, Carrington & Sleeper 373,269
Musical instruments, tool for cutting seats for insulator attachments for, Dewing & Bennett. 373,393
Nail. See Tapered nail.
Nail with countersunk head, J. W. Higgs 373,291
Needle and case, suture, J. L. King 373,372
Netting, horse, G. W. Kelsey 373,371
Octave coupler, J. S. Brand 373,122
Oil cup, J. E. Dunnigan 373,059
Optical recording instrument, H. G. J. Stang 373,206
Organ reed, L. A. Wood 373,118
Padlock and chain, G. Bradford 373,218
Padlock, permutation, A. Rodegard 373,155
Paper cabinet, toilet, J. P. Onderdonk 373,301
Paper holder and binder, Halsey & Pomeroy 373,184
Pavement, artificial, J. W. MacKnight 373,295
Percolator, W. Suits 373,420
Photographer's plate holder, W. H. Fuller 373,231
Photographic sheets, apparatus for making multiple, O. L. Hulbert 373,404
Piano wrest plank, T. M. Antisell 373,262
Pipe. See Drain pipe. Tobacco pipe.
Pipe coupling, C. Turner 373,109
Planing machine, wood, G. S. Myrick 373,411
Planter, J. H. Eleward 373,226
Planter, corn, A. S. Winings 373,212
Planters, anchor for check row corn, J. C. Barlow 373,170
Planters, attachment for corn, L. Pfister 373,092
Plow, G. W. Carr 373,051
Plow, J. H. Donaldson 373,131
Plow, cultivator, B. F. Johnson 373,187
Post anchor, W. P. Logan 373,240
Press. See Baling press. Seal press.
Printing apparatus, J. Jacobson 373,236
Printing machine, Fowler & Henkle ..... 373,353 to 373,356
Printing machine, F. Wuelfing 373,119
Printing press throw-off, H. Swain 373,421
Projectile, J. G. Butler 373,387
Propeller shaft, screw, I. E. Clifford 373,339
Pulverizer and cornstalk cutter, combined. D. Johnson 373,370
Pulverizing lumpy ground, implement for, G. Staples 373,157
Pump, force, H. Q. Hood 373,367
Pyrosulphates, making, H. Baum 373,264
Radiator, Hopson, Jr., & Daniels 373,070
Rail drill, M. W. Smith 373,318
Railway cattle guard, J. T. Gilbert 373,389
Railway crossing, automatically adjustable, T. McGrath 373,149
Railway, electrical, B. Bidwell 373,046
Railway grip, cable, H. R. Taylor 373,106
Railway rail joint, H. D. Cone 373,052
Railway shunt, F. W. Kalbfleisch 373,294
Razor, safety, H. G. Fiske 373,395
Refrigerating, system of and apparatus for, A. Snyder 373,319
Refrigerator building, C. A. Fredericks 373,228, 373,229
Register. See Check register.
Regulator. See Feed water regulator. Temperature regulator.
Roller mill, J. D. Mawhood 373,241, 373,408
Roof valley, J. E. Carroll 373,129
Roofing, cap former for standing seams of, Caldwell & Peterson 373,335
Roofing machine, tin, F. T. Baldwin 373,215
Roofing material, process of and apparatus for manufacturing, H. M. Miner 373,085
Roofing, metallic, L. H. Montross 373,373
Rope fastening, C. A. Gloekler 373,183
Rotary meter, gas, Johnston & Carll 373,406
Rubber roll, hard, F. Snyder 373,101
Rulers, protractor and circle scribing attachment for, J. G. Smith 373,100
Sash fastener, J. T. Lister 373,143
Saw filing device, O. J. Marsh 373,148
Saw machine, drag, C. W. Wright 373,260
Sawmill, reciprocating, W. M. Wilkin (r) 10,882
Scale, plantation weighing, L. R. Witherell 373,326
Screw tap, L. D. Castle 373,270
Screw, wood, H. K. Jones 373,074
Seal, car door, H. B. Schofield 373,200
Seal, lead, F. W. Brooks 373,382
Seal press, A. B. Schofield 373,201
Seaming machine, can, J. M. Mungiven 373,150
Seat. See Sewing machine seat.
Separator. See Magnetic separator.
Sewing machine automatic tension, J. H. Whitney 373,163
Sewing machine button feeding device, button, W. E. Bennett 373,330
Sewing machine fan attachment, H. H. Herrington 337,366
Sewing machine feed, J. C. Daggett 373,391
Sewing machine feed adjusting device. J. H. Whitney 373,164
Sewing machine quilting frame, H. S. Taylor 373,320
Sewing machine seat, J. H. Mahan 373,144
Sewing machine tension device, J. W. Foster 373,179
Sewing machines, presser foot attachment holder for, E. Seitz 373,312
Shade holder, F. Rhind 373,154
Shaft hanger, W. T. Carroll 373,337
Shafting hanger, H. P. Humphrey 373,071
Sheet associating mechanism, L. C. Crowell 373,224
Shoe, E. N. Cunningham 372,054
Shoe, combined button and elastic, Freed & Affleck 373,230
Shoe soles, device for inking the edge of, W. W. Crooker 373,390
Shutter worker, F. B. Mallory 373,147
Sign frame, H. S. Works 373,384
Signal. See Car signal. Telephone instrument signal.
Signal apparatus, electric train, Tiffany & De Mier 373,160
Signal light, revolving, W. Bolson 373,047
Sleigh, A. H. Sawyer 373,198
Sower, wheelbarrow grass seed, G. V. H. Whitbeck 373,162
Speculum, J. R. Hamilton 373,361
Spinning machines, bobbin catch for, I. L. Allen 373,261
Spring. See Door spring. Vehicle spring.
Spring, W. I. Bunker 373,386
Stamp mills, guide for, J. D. Peregrine 373,092
Stanchion, cattle, A. W. Streeter 373,252
Staple driver, W. W. Bloodworth 373,265
Steam engine, S. E. Jarvis 373,072
Steam engine, H. H. Westinghouse 373,323
Stencils, compartment case for interchangeable lock, S. G. Monce 373,086
Stone sawing machine, North & Sheldon 373,300
Stones, machine for gathering, J. Van Hosen 373,110
Stopper. See Bottle stopper.
Store service apparatus, J. F. Camp 373,268
Stove, parlor, E. Bussey 373,127
Stroke jointer, Jenner & Eiserer 373,293
Surgical instrument holder, J. R. Hamilton 373,362
Surgical uses, water reservoir for, J. R. Hamilton 373,400
Syringe, J. R. Hamilton 373,398
Syringe reservoir, J. F. Ward 373,322
Table. See Extension table.
Tack capping machine, W. & L. W. Gates 373,284
Tapered nail, J. Hyslop, Jr 373,234
Telegraph key, A. Oakes 373,152
Telegraphy, railway, G. T. Woods 373,383
Telephone exchange, acoustic, W. H. Eastman 373,060
Telephone instrument signal, J. M. Baker 373,043
Temperature regulator, electric, L. F. Easton 373,061
Tent, umbrella, H. J. Rumrille 373,378
Terapeutic battery, M. A. Morehouse 373,088
Thill coupling, F. L. Burton 373,174
Toaster, J. A. Downey 373,276
Tobacco box, A. L. Gresham 373,233
Tobacco pipe, A. Werner 373,258
Tombstones, securing pictures to, S. R. Miller 373,243
Tongs, fire, H. F. Stinde 373,418
Tooth, artificial, J. J. R. Patrick 373,302
Tooth, artificial, E. H. Sherman 373,099
Tooth crown, artificial, G. Evans 373,346
Tooth crowns, manufacture of artificial, G. Evans 373,347, 373,348
Toy locomotive, E. J. Colby 373,223
Trace fastener, S. M. Stevenson 373,251
Transoms, sashes, etc., pivot for, F. D. Paradise 373,413
Trap. See Fish trap.
Tricycle, H. T. Frie 373,282
Trousers, M. N. Sevier 373,313
Trousers stretcher, G. J. Rupprecht 373,379
Trousers stretcher, W. H. Young 373,120
Trucks, shoe attachment for car, E. H. Newman 373,247
Trunk corner, F. Garcia 373,232
Trunk lock, A. H. S. Davis 373,176
Truss, G. W. Bible 373,045
Tug, shaft, W. E. Moore 373,087
Typographic apparatus, hand, M. Eck 373,344
Unloading apparatus, B. Chalfant 373,222
Valve, balanced slide, H. T. Giles 375,182
Valve controller, automatic, J. Wheeler 373,324
Valve controller, electric, G. M. Sternberg 373,103, 373,104
Vehicle spring, W. S. Bulett 373,171
Vehicle spring, W. I. Bunker 373,267
Vehicle, spring, H. A. Moyer 373,375
Vehicle, two-wheeled, B. F. Myers 373,090
Vending apparatus, automatic, C. H. Russell 373,415
Vessel safety jacket or hood, W. D. Duncan 373,133
Vessels, means for securing in position the framework of, T. M. Rees 373,095
Vibrating engine, D. D. Hardy 373,287, 373,288
Wagon jack, Loucks & Derrick 373,189
Warps, apparatus for balling, Frye & Wade 373,180
Wash board, S. Bingham 373,217
Washer cutter, J. Burger 373,126
Watch case, E. Heffernan 373,364
Water or other closet, lavatory, etc., P. Everitt 373,135
Weather warning indicator, F. J. Miller 373,299
Wheel. See Car wheel.
Wheels, machine for cutting worm, J. A. Norstedt 373,192
Whiffletree, J. F. Bales 373,328
Whip button, C. E. Williams 373,166, 373,167
Whip cap, C. E. Williams 373,165
Wig or similar article, L. F. Marshall 373,297
Windmill, J. Mossman 373,089
Window, P. D. La Fayette, Sr 373,238
Wire netting, flat spiral, Einbigler & Adler 373,177

DESIGNS.

Badge, J. K. Davison 17,887
Box, J. H. Biermann 17,873
Costume, lady's, J. Sheils 17,883
Fabric, J. Z. Coblens 17,879
Fabrics, ornamentation of, W. S. Friedlander 17,880
Lamps, harp for hanging, A. Patitz 17,881
Polonaise, lady's, M. Turner 17,885
Skirt, lady's walking, J. Shels 17,882
Skirt, lady's walking, M. Turner 17,886
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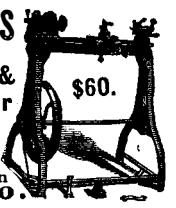

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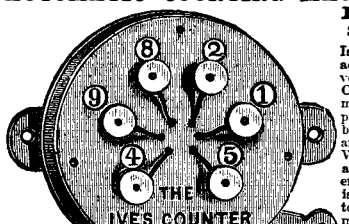

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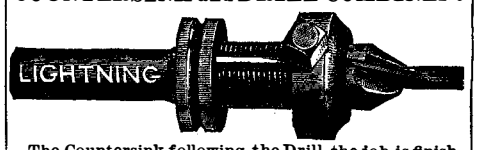

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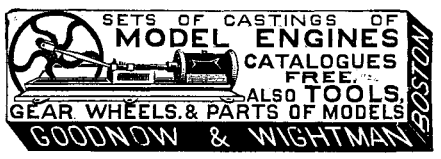

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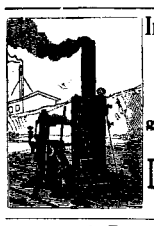

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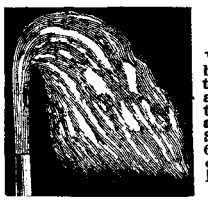

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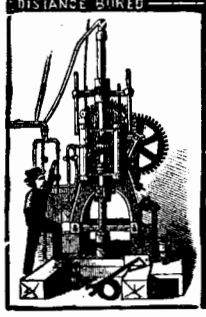
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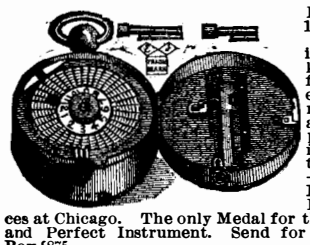
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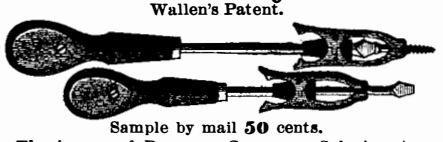
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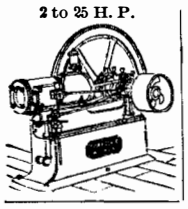
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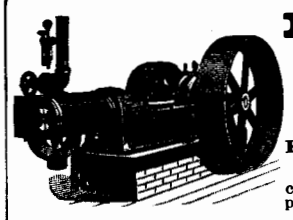
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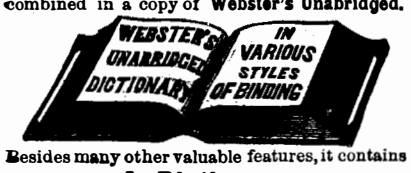

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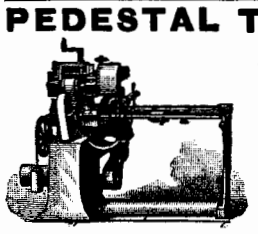
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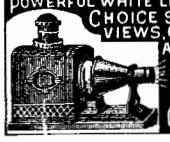
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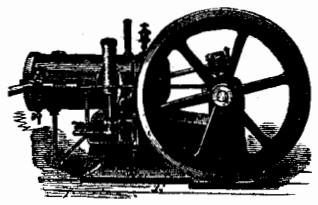
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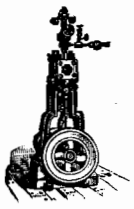
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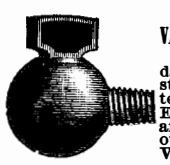
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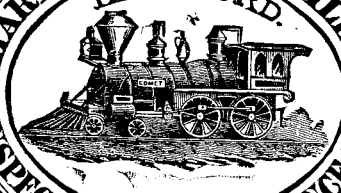

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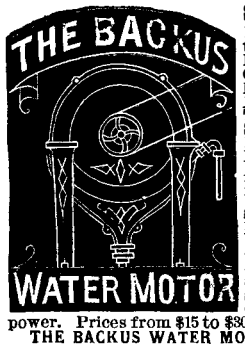

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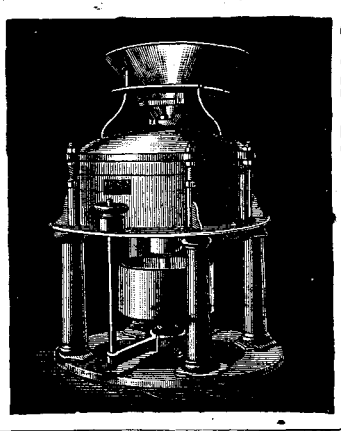

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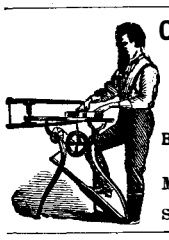

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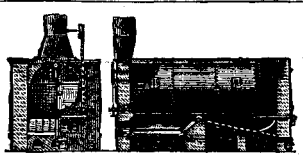

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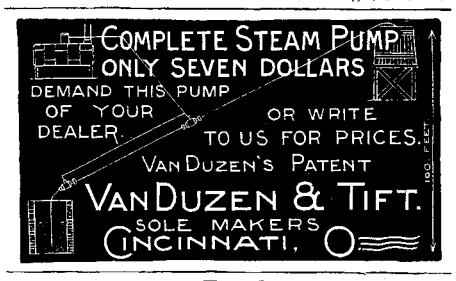

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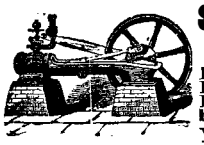

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